Better Crops with PLANT FOOD

Aug.-Sept. 1938 10 Cents

The Pocket Book of Agriculture

AVAILABLE LITERATURE

The following literature on the use of fertilizers in profitable soil and crop management is available for distribution. We shall be glad to send these upon request and in reasonable amounts as long as our supply lasts.

Circulars

Potash Pays on Grain (South)
Greater Profits from Cotton
Tomatoes (General)
Asparagus (General)
Vine Crops (General)
Sweet Potatoes (Mid-Atlantic)
Southern Tobacco Recommendations
Grow More Corn (South)
Fertilizing Small Fruits (Pacific Coast)
Potash Hungry Fruit Trees (Pacific Coast)
Better Corn (Midwest) and (Northeast)
The Cow and Her Pasture (Northeast)

Reprints

K-2 Potash Increases Corn Yields Following Sweet Clover
H-5 Connecticut Valley Soils Need Potash
I-5 Apple Trees Need Balanced Diet
I-6 Virginia Tobacco Needs Potash
J-6 Soybean Trends
K-6 Fertilizing Pennsylvania Cigar-leaf Tobacco
AA-6 Meet Our Old Friend Timothy
HH-6 Flower Symptoms Warn of Food Deficiency
NN-6 Ohio Checks Fertility Needs of Vegetables
OO-6 Fertilized Legumes Pay Big Profits
PP-6 Deciduous Orchards Need Plant Food
QQ-6 Fertilizer Distributors for Seed Drills
A-7 Permanent Grassland Has Cash Value
D-7 Successful Strawberry Practices in the South
E-7 California Prunes Respond to Potash
G-7 Mineral Fertilizers for Pasture Improvement
H-7 Potash for Cotton in the Delta Foothills
J-7 Meet Indiana's 1936 Onion King
K-7 The Tung Oil Industry in Mississippi
M-7 Better Crops of Better Quality (Corn)
N-7 Will Potash Benefit Your Apple Orchard
R-7 Results with Potash in Eastern Virginia
U-7 Fertilizers for Better Asparagus (Northeast)
W-7 A Modern Pioneer—J. W. Hadden (Cotton)
X-7 On Apple Orchards Use "Congenial" Fertilizers (Northeast)
Y-7 Asparagus in Ontario
Z-7 Apply Boron to Prevent Darkening of Turnips
BB-7 Fertilizer Response on Colby Silt Loam
CC-7 Replace Plant Food Losses in Crops
EE-7 The Role of Potash in California Soils
GG-7 Shall It Be Soil-mining or Soil-building
HH-7 High Potash Fertilizers for Fall Use
JJ-7 Atkinson Demonstrates That It Can Be Done
LL-7 Fertilize to Control Cotton-belt Erosion
MM-7 Raising Quality Fruit on a Large Scale
NN-7 The Use of Soil Tests in Conservation
OO-7 Study Starvation Signs on Tobacco and Cotton
TT-7 Take the Guesswork Out of Wheat-growing
UU-7 Better Yields of Better Cotton
VV-7 Diagnosing Fertility Needs of Orchards
WW-7 Potash Enters the Dairy Business
XX-7 We Met the Change in Burley Tobacco
ZZ-7 Crotalaria Is Good for Southern Soils
DDD-7 Growing Tomatoes with Chemical Fertilizers
EEE-7 Mississippi "Sweets" Need More Potash
A-8 Fertilizer Placement Influences Profit
B-8 Commercial Fertilizers in Grape Growing
D-8 Raising Pure-bred Seed for the South
E-8 Rapid Chemical Tests Show Soil Needs
F-8 Using Soil Tests To Get the Picture
G-8 Green Pastures
H-8 Fertilizer Developments in Mississippi
I-8 What's Wrong With Your Alfalfa Crop
J-8 When, How, and Why Fertilize Your Lawn
K-8 Safeguard Fertility of Your Orchard Soils
L-8 Soil Tests Improve Canning Crops
M-8 A Primer Explaining Cotton Disease Control
N-8 Out of the Wealth of Our Soils (Midwest)
O-8 Corn Can Be Grown on "Frenchy" Soils (South)
Orchard Fertilizer Practices Determined by Diagnosis
How to Determine Fertilizer Needs of Soils
Some Results of Mineral Deficiency Studies
P-8 Profitable Cows Need Productive Pasture
Q-8 Corn on Alkali Soils Responds to Potash
R-8 New Approaches to Potash Fertilization
S-8 Mr. Pender Specializes in Asparagus
T-8 A Balanced Fertilizer for Bright Tobacco
U-8 Tomatoes & Cucumbers Reveal Diet Needs
V-8 Our Responsibility with Manure
W-8 Red Raspberries Need Complete Fertilizer
X-8 Can Sea Island Cotton Return to Georgia?
Y-8 Potash Is Needed in Southern Illinois
Z-8 Orchards Differ in Fertilizer Needs
AA-8 Were the Professors Wrong?

AMERICAN POTASH INSTITUTE, INC.

INVESTMENT BUILDING **WASHINGTON, D. C.**

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Office: Investment Bldg., Washington, D. C.

VOLUME XXII NUMBER SEVEN

TABLE OF CONTENTS, AUGUST-SEPTEMBER 1938

Which, and if so, Why? 3
Jeff Examines Educators and Organizers

Permanent Clovers for Permanent Pastures 6
Have Proved Their Value, Says A. R. Midgley

How I Control Black-Spot 10
Charles Mallerin Describes His Treatment

Cooked Potatoes Blacken Because 12
They Need Potash, According to A. W. Hantke

Keep Bees for Fruit and Honey 15
A. B. Bryan Cites Specific Advantages

Collecting the Price 17
A Story of Better Business Practices, by C. B. Sherman

DIXIE—Land of Cotton and Forests 18
Lyle Brown Discusses Current Developments

Strike a Balance of Soil Fertility 20
Recommends R. E. Stephenson

Quality Potatoes from Muck Soils 21
N. Kent Ellis Tells How to Grow Them

American Potash Institute, Inc.
Investment Building, Washington, D. C.

J. W. TURRENTINE, *President and Treasurer*

G. J. CALLISTER, *Vice-President and Secretary*

ONE OF THE PERILS OF MARKETING QUALITY PRODUCE

Better Crops with PLANT FOOD

PUBLISHED FOR THE AMERICAN POTASH INSTITUTE, INC., INVESTMENT BUILDING, WASHINGTON, D. C., SUBSCRIPTION, $1.00 FOR 12 ISSUES; 10¢ PER COPY. COPYRIGHT, 1938, BY THE BETTER CROPS PUBLISHING CORPORATION.

VOL. XXII WASHINGTON, D. C., AUG.-SEPT. 1938 No. 7

Which, *Education or Organization—and if so,* Why?

By Jeff McDermid

BEING in a meddlesome profession and argumentative by nature and disposition, I arise to propound a useless question. I ask you if anybody knows which has done the more for agriculture—education or organization? Around our parts there are quite some considerable proponents, not to say adherents and bigoted believers, in the virtue and value of both. Having mingled with these cranks for many moons and dealt with them in a professional way; and being guilty of advancing ideas more or less half-baked which they sometimes gave me for public digestion, I am in a neutral position between the lines.

I have no fixed opinions either for or against the long-haired savants or the leather-lunged leaders, so I can meander up to and edge all around this profound topic without becoming vexed or visionary. Moreover, not being very highly organized or intensely educated myself, I can sit down out in the sticks with some geezers in overalls and let them take the hide off both these noble institutions without blanching.

I firmly believe that these back-country skinning operations and dissecting debates would be good medicine for plenty of the rural educators and rural organizers too, just as it is good stuff

for me to take a course in English composition once in awhile.

I presume this question is like the old wheeze about the priority of the hen or the egg. I suspect that it's mighty hard to tell which came first, education or organization of, for, and by farmers. Even if we went clear back to fundamentals and tackled old Adam, the original horticulturist, I suppose both the professors and the organizers would get their innings. No doubt the teachers would say that if Adam had been well educated beforehand he would not have eaten any pippins until they were sprayed and graded; and the joiners would reply that if he and his frau had been properly organized they could have stayed in Eden regardless of the snakes or the angels.

AND following up later history since we began to settle America in earnest, I suppose both sides would have to admit some degree of active partnership. That is, we farmers could not have secured free education without some organization, and organization seldom gets very far minus both leadership and followship. (I use "free" before education advisedly, although I know that many taxpayers see red when it is so described.)

Folks who attend farm society meetings know full well that it takes plenty of persuasion to keep the boys hooked up and steam heated to pull steady in harness. Part of that persuasion is straight education, and the rest of it is enthusiasm—otherwise known by another less dignified name. Other folks familiar with the doings in regent meetings and boards of education know that organized effort puts over more new courses and new appropriations than book larnin' ever did.

Personally, I think right at the present time organization is running a trifle ahead of education in direct effect on farmers. I refer mainly to the agricultural conservation program as I observe it. Here you have a glorious example of how well a set of educated leaders can set up a national machine with well-integrated local cogs and levers, and make it work without most farmers knowing much about the reason why or the modus operandi.

Plenty of farmers I meet are no better off above the collar button since the program began, but their bank reserves and alfalfa acreages are somewhat bulkier. Most of the education has stayed in the headquarters offices and in the bulletins and regulatory rule books, while the benefits have got into the soil. This after all is nothing to worry over.

Now mind you, I do not claim that the soil committeemen are the only educated farmers we have anent the program specified, which possible error I hasten to correct. There are indeed many, who by prior training or personal research, or through political leanings, are convinced that it is all right or all bunk, depending on their respective viewpoints. But no checks have been returned just the same, not even by the widows of the opposition, as far as I know.

One might conclude hastily that this signifies the first instance in agricultural history where either education or organization has panned out into hard cash to farmers for small effort, but mark you, I have not said that myself. I don't want you to quote me on anything which is apt to shut off my sources of inspiration. Charlie McCarthy and I both need help to put on a performance. (Many others do too, but they won't admit it.)

SOME association with lawyers taught me that before going into a case too far we must fix our limits and set our sights. This calls upon me to define what I mean by organization and education, because the world is full of things which are called by those names whether they deserve it or not.

By organization in this little thesis I mean a degree of agricultural unity directed toward progress in achievement of goals. These goals are varied enough goodness knows, but for this purpose I confine it to organization in the realm of plant and livestock breeding and or-

ganization dedicated to social, economic, and moral improvement.

By education I mean the acquisition of new ideas and principles. In farm life education has always taken at least two broad and not always related courses. Educated farmers are those who have acquired dexterity and skill in the use of new implements, equipment, and methods, and who have sufficient familiarity with them to work independently with more or less assurance of success. Likewise, educated farmers are those who have not overlooked the value of acquiring knowledge of economic trends and doctrines, history, scientific facts and principles, and who keep up alertly with current events.

Now we can leave out the commonplace system of dividing all education into bookish kinds and practical kinds. I see in my acquaintance with farmers a great mingling of the mental and the manual. One complements the other and both are essential in the rounding out of a satisfying life anywhere.

WITHOUT doubt the average farmer has acquired far more of the mechanical and inventive education and put it to greater daily use than he has the less positive branch of learning. I doubt much if we would be able to keep our youngsters back home on the farm were it not for the modern ways of doing things and the inspiration it gives them to possess this speed, power, and ease of achievement. I often journey through a countryside which was settled in the days of the flail, the ox cart, and the candle; and every field at harvest time has its tractor-binder or combine, and each home has its brilliant electric light and pulsing power.

Here it seems to me lies a field in which education rules supreme with less help from organization, as such, than in other more mental and abstract lines. Many would close the chapter here and declare the case won. But this does not include enough of the picture to make a finished masterpiece. It is but one side of the question.

FORMAL education such as the high schools and the agricultural colleges teach has always tried to include both the manual and mechanical courses and the classwork in the realm of the mind; but unfortunately too many of the graduates turned from farm life to commercial pursuits and spoiled the result in the eyes of those back home, that is, those who wanted rural communities to absorb major benefits from each new career. It would be foolish to insist, of course, that he who is born on a farm must stick by the family tradition, which observation I insert because it is the basis of much misunderstanding and misdirected living.

But there is still a rather nice discrimination we must mention. It hovers on the border line between our two subjects, education and organization. It bobs up often in everyday contacts with farm folks.

In my experience I have frequently noted that the more highly skilled, the more self-reliant and purposeful farmers, and again, those with considerable formal training, have shunned the hurly-burly and horse-play of mass farm organizations, particularly on the economic and social side, and have gravitated more generally, if they did so at all, toward the plant and animal improvement societies. Sometimes they even deserted the latter.

(*Turn to page* 47)

Permanent Clovers for Permanent Pastures

A. R. Midgley
Agronomist, Agr. Exp. Station,
Burlington, Vermont

WHAT place does clover have in permanent pastures and what is the relative value of individual strains with different fertilizer treatments? To determine these questions considerable research work has been conducted at the Vermont station, using Ladino, common white Dutch, English and natural wild white clovers.

Characteristic Growth

Ladino is a mammoth white clover which originated in northern Italy and was brought to this country in 1912. It has an erect habit of growth with large leaves and long stems, which enables it to compete with the tall-growing grasses. Ladino, however, cannot stand as close grazing as the other clovers because of its erect habit of growth, large fleshy runners which are quite easily injured by the tramping of grazing stock, and its long internodes which do not form a very close turf. It has a remarkable comeback after being cut or grazed and under proper conditions yields more than other clovers.

Common white Dutch clover has growth habits intermediate between the Ladino and wild white clovers. The plants have larger leaves, fewer and stouter runners than the wild white types, and because of its longer internodes it does not root or spread so readily. It usually has a longer growing season, since it often starts growth earlier in the spring, blooms 1 to 2 weeks earlier, and continues growth later in the autumn than the wild strains.

English wild white clover has very small leaves, short stems and internodes, and forms a close, compact turf. This plant is much smaller than the other clovers and thus requires close grazing to get sufficient light in competition with other, taller-growing plants. England has found this clover to be a true perennial, a long-lived, persistent, rapidly-spreading type. It has been the main contributing factor in making the pastures and livestock of Great Britain so famous. Their pastures are seldom if ever plowed, and they take great pride in referring to their "old pastures." Seed from these old established pastures are used for the reseeding of other pastures.

Natural wild white clover has growth habits intermediate between the small English wild white and common Dutch varieties forming a close, compact turf. This clover is found in old permanent pastures or comes in under proper fertilization and management. It is quite likely that these plants are the more persistent strains which originated from the common white Dutch clover, as available evidence indicates that this clover is a native of Europe and was brought to this country by the early settlers in hayloft sweepings. It took root readily and is now found along practically every road and forest trail. Some Indian tribes called this plant "White Man's Foot Grass," as it seemed to follow white men, establishing itself readily on newly cleared or burned-over forests where fertility and organic matter contents were high. Natural selections have no doubt taken place, and as it readily establishes itself under proper conditions, it can well be called natural wild white clover.

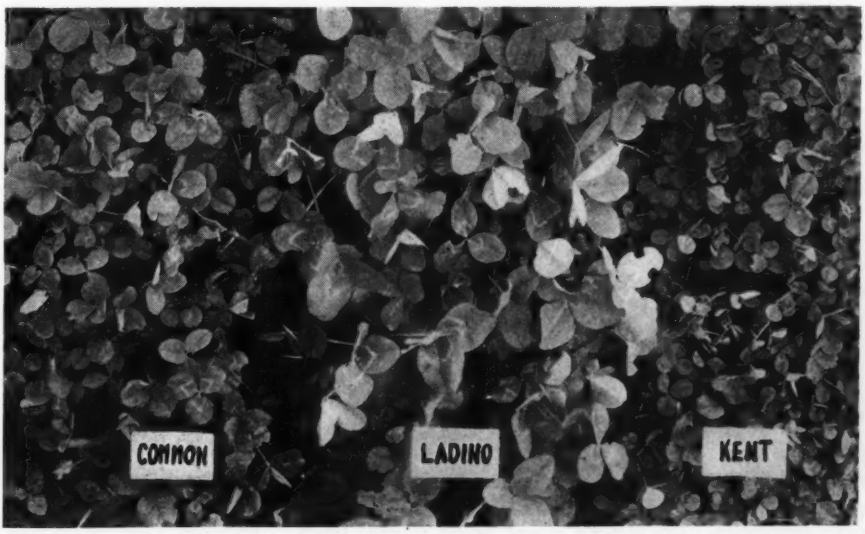
Experiments were started in the spring of 1934, using these four clovers, on three different soil types. Since the data from the three experiments were similar, only one will be discussed here. Woodbridge loam, because of its importance as pasture land, was selected for one of the trials. This soil occupies the gently rolling hillsides in the north central plateau of Vermont. It is derived mainly from granite, and while it is non-calcareous at all depths, it is not so acid as to prevent a good growth of pasture clovers and grasses (pH 5.6). While this area has a rolling topography, it is still quite ideal for pasture clovers, because its compact substratum (hardpan) retards the movement of water and thus supplies sufficient moisture.

Nature of Experiment

A sufficient area was plowed, fitted, and seeded to Ladino, common white Dutch, and English wild white clovers. Adjacent unplowed areas containing some native wild white clovers were used as the fourth type, since seed for these plantings were not available. Ladino and Dutch seed were obtained from a reliable seed house, English wild white seed directly from London and was certified as "Genuine Kent wild white clover from old pastures." Seeding was done at the rate of 5 pounds per acre, which is in excess of the normal rate but deemed advisable to insure good stands. Normal seedings of timothy and Kentucky bluegrass were used with the clovers in order to simulate pasture conditions.

A part of each plot was enclosed within a wire fence, the remainder being subjected to actual grazing conditions. Yield data were obtained only on the enclosed areas. The plots were cut frequently when 4-6 inches high, in order to favor clover rather than the grass. The results are presented in tables 1 and 2.

The results presented in table 1 show the superiority of natural wild white clover in persistence and longevity. It continued to increase each year, while the other clovers greatly decreased after the third growing season. Why natural wild white clover is more persistent than the other clovers is not definitely known, but it is true that white clovers growing in various habitats show marked differences, such as size and number of leaflets, length of nodes, manner of growth color of flower, etc.



This is the first year's growth of these three clovers which were planted in adjacent rows. Note the difference in size of their leaves.

TABLE 1—PERCENTAGE OF EACH CLOVER PRESENT ON WOODBRIDGE CLAY LOAM WITH DIFFERENT FERTILIZERS AT THE END OF THE FIRST AND THIRD YEARS AFTER SEEDING

	Nature of Fertilizer Application[1]				
	Check L	L+P_1+K_1	L+P_2+K_2	L+P_2+K_2+N	L−P_2−M
	Native Wild White Clover				
1934	7	10	10	11	12
1936	9	22	75	60	78
	Ladino Clover				
1934	52	75	85	85	87
1936	3	6	10	6	12
	Common White Dutch Clover				
1934	50	78	82	78	80
1936	2	4	6	5	8
	English Wild White Clover (Kent)				
1934	35	70	80	76	81
1936	3	2	6	4	7

[1] P_1=500 lb. 16% superphosphate. P_2=1,000 lb. superphosphate per acre. K_1=200 lb. muriate of potash. K_4=400 lb. muriate of potash per acre. N =300 lb. ammonium sulfate alternated with eq. sodium nitrate yearly. M=8 tons of fresh barnyard manure.

It is likely that some strains have a deeper root penetration and are thus better able to withstand drought and midsummer heat, as well as utilize to better advantage soil minerals which are more or less held in difficultly available forms.

The creeping stems or stolons of wild white clover are small and tough, so they may not be injured by tramping and grazing stock to the same extent as the types with more fleshy stems. They also tend to stop active growth earlier in the fall and thus store more food reserves in their roots, which would help make them more resistant to heaving and winter-killing. It is possible that they are more resistant to diseases, more tolerant of soil acidity, and produce more seed under close grazing, but whatever the cause, natural wild white clover is more persistent than the other strains that have not been subjected to soil and climatic conditions peculiar to a particular locality.

It is a waste of time and money to plow and reseed without adequate fertilization. This plot was plowed, seeded to white Dutch clover, bluegrass, and timothy. A very poor turf resulted and the soil baked and cracked badly.

The common white Dutch decreased most rapidly, as very few plants remained after the second year. It may even be that some of these plants reported in 1936 came from seed which failed to germinate the previous year or was an incropping of the na-

Unplowed and unfertilized native sod. The turf and thin layer of organic matter help prevent excessive evaporation. Note the small amount of native wild white clover.

tural wild white clover, as these two types are difficult to differentiate. It is little wonder that white Dutch is not more persistent, as much of the seed is produced in foreign countries or in the southern States where the climatic conditions are very unlike those in the northeastern States.

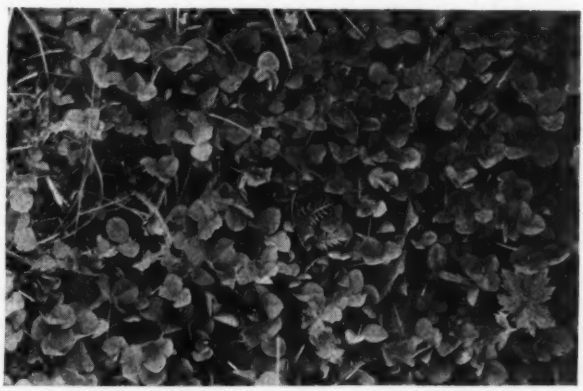
Ladino clover seldom lives more than 2 or 3 years in Vermont, but it was somewhat more persistent than the common white Dutch variety. Here again, part of the plants recorded in 1936 may have been from seeds which failed to germinate the previous year, or came from freshly produced seed.

Though the English wild white (Kent) is considered a true perennial in England, it also rapidly decreased in these experiments. It is possible that this clover may have been more persistent if the plots had been cut more frequently; but in actual practice, especially under rotational grazing, it is doubtful if the plots would have been more closely grazed, since they were cut five or six times a season when growth of 4 to 6 inches was attained. This clover may also have been more persistent if the original sod could have been utilized, but since the land was plowed in preparing the seed bed, the organic matter was turned under and was then positionally unavailable to the clover.

Fertilizer plays an important role in maintaining pasture clovers. The high rate of superphosphate with manure proved best in this respect. Manure not only supplies potash, but soluble organic matter and minor elements which have a beneficial effect in maintaining and establishing clovers. "Night pastures," which naturally receive large amounts of manure, usually have a good stand of white clover. This is not due to its nitrogen content, since this usually decreases the percentage of clover.

The results presented in table 2 show that yields are greatly increased by the use of fertilizers, and that this yield is in proportion to the fertilizer used. While nitrogen and minerals gave the greatest total yield, the added nitrogen did not give sufficient increase to pay for its use. This would be expected under these conditions where a good stand of clover was present, since the

(*Turn to page* 40)



High mineral fertilization without plowing and seeding changed the turf of poverty grass and weeds to a good stand of persistent natural wild white clover.

Reprinted from 1938 American Rose Annual

How I Control Black-spot

By Charles Mallerin

Amateur Rose Hybridizer, Vice-President of the Rose Section of the National Horticultural Society of France, Varces, Isère, France

EDITOR'S NOTE.—It is through the kindness of Prof. Earl J. Hamilton, of Duke University, Durham, N. C., now engaged in research work in France, that this remarkable paper, which he has translated, is made available to us. M. Mallerin speaks from experience, and Professor Hamilton's letter accompanying the translation tells us, "I have never seen black-spot so completely controlled as it was at M. Mallerin's establishment last October. Nor was the climate responsible, for roses in that district that had not received his type of fertilizer were largely defoliated by black-spot." Obviously, M. Mallerin is controlling black-spot *from the inside,* through larger use of potash—a proposition for careful study.

Readers are urged to experiment cautiously in the lime-sulphur spray application, for American suns are harsh in comparison with those of France.

SEVERAL rose-lovers from France and other countries have taken note of the results attained in my fight against black-spot, which was practically non-existent in my establishment in 1937. In response to their desire to learn the causes of these results, I am glad to make them known.

First, one must recognize that the disease singles out the varieties which have a deficiency of foliage at certain periods, particularly the first leaves of maidens after they are cut back. Next come the Pernetianas, especially the early varieties, which at present are resistant, their congenital weakness having been overcome. Finally, come the little cutback seedlings.

Rose hybridizers know that new varieties attain more or less the characteristics of a normal plant when they are budded onto understocks, but that the seedlings on their own roots generally remain poor plants, and that when cut back a large percentage dies. This extraordinary vegetative deficiency subjects seedlings to frequent attacks of black-spot that are difficult to control. Hence, if I had neglected to provide fungicidal protection, my visitors in October, 1937, would have found black-spot as bad as in their own gardens.

I have also observed that if one stimulates growth by application of nitrogenous fertilizers in the spring or (in liquid form) during the summer, severe attacks of black-spot and mildew are invited. The cause of this is the excess of nitrogen.

A friend (a leading rose nurseryman) to whom I have given advice for rendering his fields immune to black-spot has not had completely satisfactory results. One must partially attribute this to insufficient fungicidal protection at the proper time. Another important factor was a deficiency of lime in the soil; a pH too low produces foliage of inferior resistance.

The problem consists then in giving plants proper soil: (1) drained when necessary, for nothing is more injurious to roses than soils lacking aëration and porosity; and (2) an adequate content of available lime, that is a pH of about 7.5. This may be called *hygiene,* and it is as necessary for roses as for men.

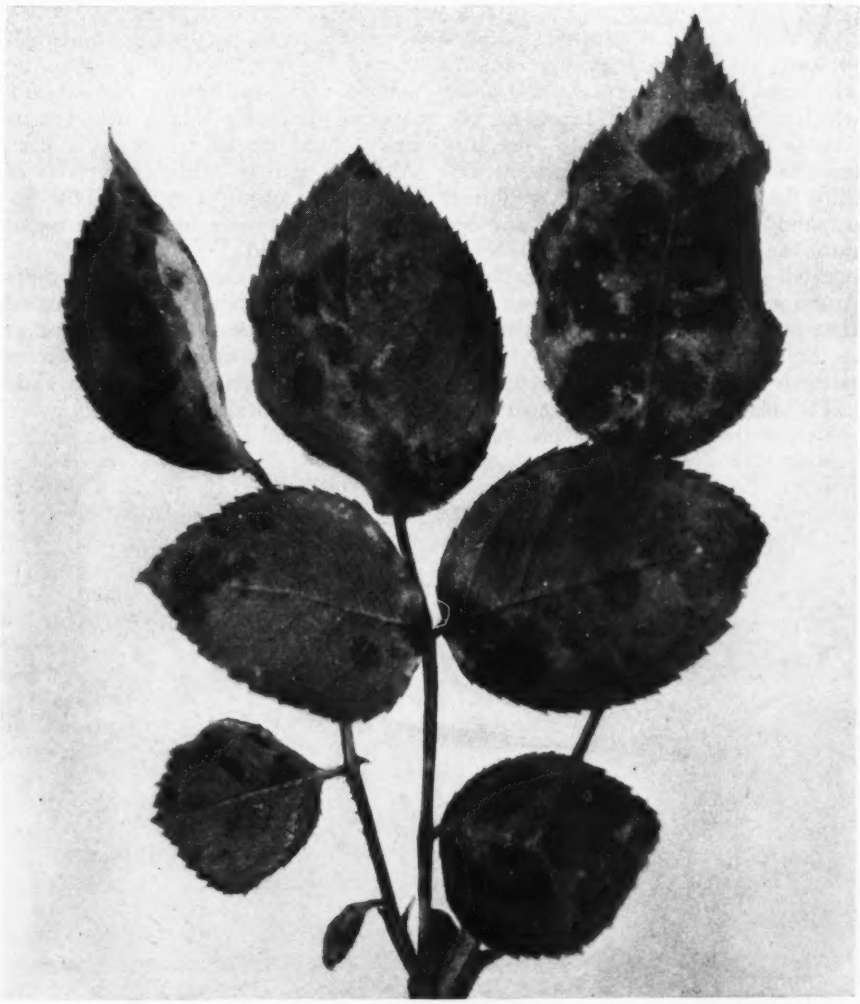
The nourishment of roses, another essential point, demands a carefully studied balance. In this matter a fortuitous occurrence put me on the right road. Like most amateurs, I used "complete" fertilizers, usually about 3 to 6 of nitrogen, 8 to 12 of phosphate, and

3 to 4 of potash. (A rose savant had written that roses need a great deal of nitrogen and very little potash.)

About 10 years ago, having pulled up all except a few plants and the border of a bed of roses, I planted beans in their place, after an application of fertilizer containing four times as much potash. I was amazed to find that the roses thrived on this heavy dose of potash. The extraordinary fact was that they had no black-spot or mildew, while their neighbors, having received the "complete" fertilizer and the habitual fungicides, were attacked by these diseases as in previous years. *It seemed evident that potash had imparted disease resistance, and systematic experimentation has confirmed my conclusion.*

No rose cultures are more difficult to protect against disease than those where one cultivates thousands of seedlings; for, while there are many sturdy varie-

(*Turn to page* 36)



© U. S. D. A., Bureau of Plant Industry, Washington, D. C.

Black-spot on rose leaves appears first as small, isolated areas scattered over the upper surface of the leaf. The spots increase in size and may grow together until almost the entire leaf is covered.

Cooked Potatoes Blacken Because . . . .

By A. W. Hantke

Madison, Wisconsin

"WHAT causes potatoes to blacken after cooking?" ask potato growers and consumers in this country. The housewife, desiring to serve food which is attractive and tempting, objects to darkened potatoes. This attitude, in turn, affects potato growers because they are striving to meet consumer demands. Due to these facts, and because the blackening of potatoes is being noticed in various sections of North America, Dr. W. E. Tottingham, associate professor of agricultural chemistry at the University of Wisconsin, began research on the subject.

The blackening, which occurs soon after harvest, is not the same type which is often seen on potatoes that have advanced stages of sprouting in spring storage. The darkening we are considering is usually found in the tissue layers just beneath the potato skin. Although it may affect all portions of the tuber, causing a gray or blue appearance, it is more likely to be found at the stem end.

The lack of minerals in the tuber causes free amino acids to form instead of proteins. Due to enzymes, some of the acids react with oxygen to form substances which become blue and black pigments after cooking.

Note the effect of the lack of boron in the soil on the plant at the left. The dying of the vegetative tip, the low side sprouts and the light color of the leaves in this plant are not present in the other two plants which are growing in soil containing boron.

Note the injury from lack of boron in the soil, and its partial correction by a liberal potassium supply. The middle plant is growing in soil low in potassium with no rare minerals, the right one is growing in soil low in potassium but containing boron and manganese, and the left plant is growing in soil high in potassium but with no rare minerals.

The blackening of potatoes is not new in the history of agriculture. According to a report by Wallace of England, the condition was found, after a dry, hot summer, in one or two varieties grown on land to which manure and a commercial nitrogenous fertilizer had been added. The trouble was overcome, to a great extent, by adding potash to the soil.

Potash is Tested

"After finding that the blackening was not caused by a disease," says Dr. Tottingham, "we considered the effect which potash in soil might have on the condition. In 1935 experiments were carried on at the university plots in Antigo, Arnott, and Madison, Wisconsin, with Burbank, Cobbler, Katahdin, and Rural New Yorker potatoes. At the time of planting, the Truog method was used to determine the amount of available potash in the soils. When the potatoes were planted, fertilizers containing different proportions of potash were placed in the furrows. It was found that in all varieties of potatoes an increase in the amount of potassium in the soil was associated with a decrease in the amount of blackening. Similar results were obtained in a greenhouse on synthetic sandy soil to which potash had been added."

During the winter of 1935 and 1936 potatoes were planted in a greenhouse on pure sand with the addition of fertilizer mixtures compounded from relatively pure salts. These salts carried boron, copper, manganese, and zinc, in addition to the more common and essential elements. The yield of tubers was good, even on a low potash supply, and none of the tubers darkened after boiling. Thus, although the level of available potash in the soil may be a critical blackening factor, in this case the potatoes grown on a low potash supply did not darken.

In 1936 experiments were carried on at Antigo, Madison, and on a new location at Hancock, Wisconsin. Although potash was added to the soil when the potatoes were planted, tests at the close of the growing season showed that, to a great degree, the potash had not remained available for the plants. The unusual dryness of the 1936 growing season was probably a factor in rendering the potash unavail-

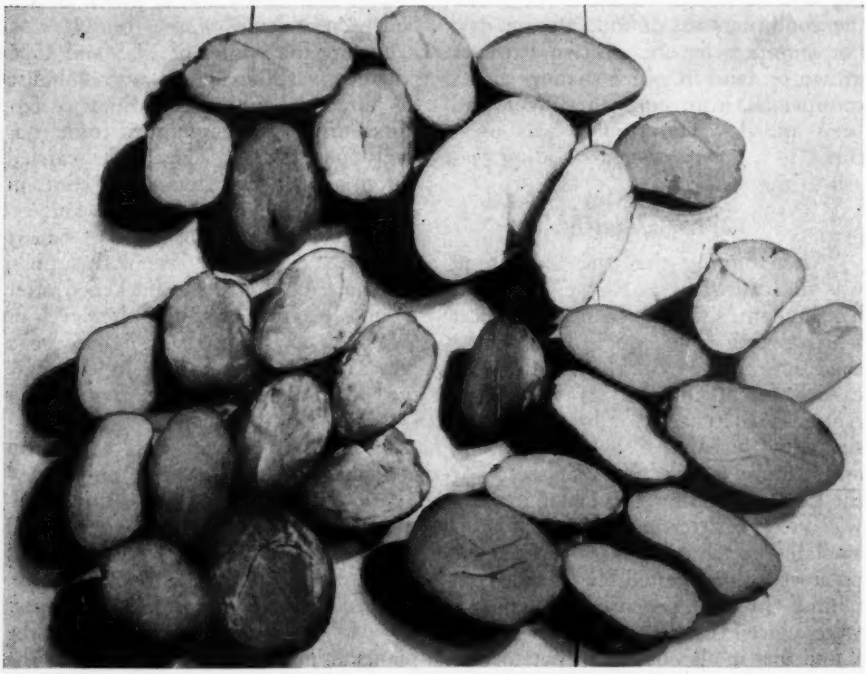
able. Since all samples of these tubers blackened upon cooking, we are led to state that potatoes raised on low potash soils or soils in which the potash is not available, show a greater tendency to darken than those grown on soils containing liberal supplies of available potash.

Effects of Rare Minerals

"Because some of the darkened potatoes contained more than 1.8 per cent potassium in their dry matter, which previously appeared sufficient to prevent blackening," continues Dr. Tottingham, "perhaps darkening is also related to the amount of rarer mineral elements, such as copper, manganese, boron, and zinc, in the soil. In the winter of 1936 and 1937 potatoes were planted in galvanized iron boxes filled with sand, to which a fertilizing salt mixture was added. Because the sand would absorb zinc from the boxes, only the copper, manganese, and boron content of the soil was varied. The Cobbler, Chippewa, and Rural New Yorker varieties of potatoes were used for this experiment."

The leaves of potato plants growing in soil containing little potash and none of the rare minerals became partially bleached and curled. Later the vegetative tips of the main stems died, and the lower branches began to grow more vigorously. The few potatoes that did grow on these plants were about the size of pigeons' eggs. This same reaction took place in plants which grew on low potassium soil to which copper and manganese, but no boron salts, were added. In fact, this boron response, which has been noticed by other research workers, was found to be typical of potato plants grown on soils lacking this mineral. Although the relationship of boron to the darkening of potatoes has not been determined, a lack of

(*Turn to page* 43)



Note the darkening of the lower left group of potatoes. Available potash was lacking in the soil in which the lower left potatoes were grown. The upper and right groups of potatoes were grown in soil having sufficient available potash and did not darken upon cooking.

Keep Bees for Fruit and Honey

By A. B. Bryan

Clemson Agricultural College, Clemson, South Carolina

THE "busy-ness" of bees is good business for farmers. This is eminently, doubly true despite the fact that bees are busy in their own interest rather than in the interest of farmers. It is true if and when farmers are intelligent enough to take advantage of the thirftiness of bees and even to encourage their thrift and their industrious activity, and then utilize their labor and the product of their labor.

Doubly true, we said. And how doubly? Flitting from flower to flower in an apparently aimless manner, bees gather nectar and in so doing fertilize to greater yields the fruits and other plants that farmers cultivate. Returning with this nectar to their hives, bees industriously manufacture it into honey to be stored for their own needs against seasons when they cannot gather nectar; and thus they are a source of an important supply of the sweets which are essential in human food. Yet many farmers fail to capitalize on bees.

Many fruit crops, but more especially apples, must have insects to pollinize them. Of course it is not the honeybee alone which is of value in this respect; but our agricultural operations have so depleted the other pollinizing insects that we now have to depend largely on the honeybee.

A great and growing industry is building up in southern sections of the United States in the production and merchandizing of bees for pollination work in apple orchards. In some cases the orchardist owns his own bees and moves the colonies into the orchard each spring just before the apples bloom. In other cases the orchardist rents the bees from beekeepers for the duration of the apple-blooming season. The usual procedure is to place the bees in the orchard at the rate of one colony or hive of bees per acre, with a special effort to place the bees near the varieties of apples which produce suitable pollen.

In many apple orchards in the United States only small or average size crops are the rule because too few bees are present in the orchards at blossoming time. It is time that orchardists and beekeepers realize more fully that there is a chance to cooperate in the matter of bees and apples to their mutual advantage. This phase of beekeeping is not yet being promoted to the full advantage of fruit growers and beekeepers.

An Early Immigrant

The honeybee as we know it in America was not originally a native insect, for there were no true honeybees in this country when the first Europeans arrived here. Of course there were the many kinds of wild bees which we still have, and there were many bumblebees native to this country. The value of the true honeybee was early recognized by the colonists, and as early as 1638 importations of honeybees were made to New England.

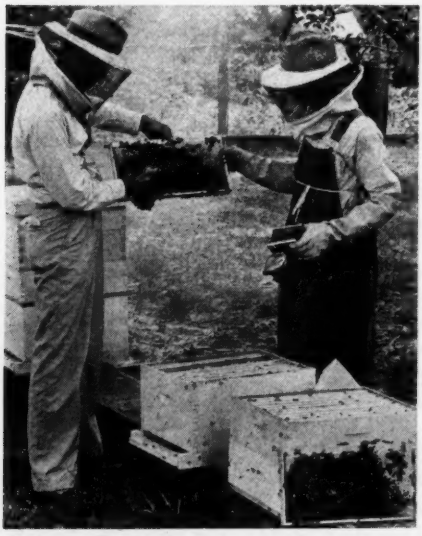
The earliest importations were of the black bee or so-called German bee from Europe, and that type is still very common in some sections of the country. However, because the yellow or Italian bee was later found to be much more

gentle and tractable, it has replaced the black bee to a large extent.

Honey, it seems, was considered a prize food long before people learned beekeeping methods that made it possible for honey to become an article of commerce. Before there was anything that could be called "beekeeping," man robbed wild bees of their stores of honey wherever and whenever he could. And what is honey, and why is it the inimitable product of one of Nature's laboratories not possible of duplication in the laboratories of man?

"Honey is a material elaborated by certain insects from the sweet secretions of blossoms of plants," one authority states. "Honey is made by several kinds of insects in addition to the honeybee. But the honeybee in its various species is the only insect which makes honey in quantities sufficient to offer commercial possibilities.

"Honey is made only from nectar gathered mainly from the blossoms of plants. Now when this nectar is gathered by the bees it is far from being real honey. Many things have to be done to it before it becomes the delicious article we know as honey. In the first place, this nectar is a weak sugar solution containing sugar identical with what we know as common white sugar. It carries also coloring materials peculiar to the plant from which it is gathered, as well as some minerals and other materials.



A county agent helps a beekeeper in more efficient beekeeping.

"Now begins a wonderful process. First, the water content is reduced by the bees from about 80 per cent to about 20 per cent. The sugar is almost completely changed from the original complex sugar to two simple sugars known as dextrose and levulose."

Valuable Human Food

Noteworthy is the fact that the two sugars found in honey, dextrose and levulose, do not need to be digested when eaten by man, but are ready to be directly absorbed into the blood stream. It is a remarkable feature of honey as valuable human food.

There are other things that happen to the nectar in the process of changing it into honey; the bees add to it certain delicate aromas during the process. These aromas make honey the distinctive "flavor food" that it is, making it impossible for men to duplicate natural honey by any synthetic product.

The two simple sugars, dextrose and levulose, which are principal ingredients of honey, do not occur in the same proportions in all honeys. Thus clover honeys of the northern states have a large proportion of dextrose and not so much levulose. On the other hand, such southern honeys as tupelo of the coastal areas and sourwood of the Appalachian mountains have an unusual amount of levulose and a smaller proportion of dextrose.

This variation in the proportion of the two sugars has a very definite effect on the honey concerned. Dextrose readily forms crystals something like ordinary white sugar, while levulose is difficult to crystallize. Thus a honey with a high proportion of dextrose, such as clover honey, will readily form crystals or "turn to sugar." A honey with a preponderance of levulose, such as tupelo or sourwood, will remain in liquid form almost indefinitely.

Collecting The Price

By C. B. Sherman

U. S. Department of Agriculture,
Washington, D. C.

A Federal inspector checking a carload of potatoes.

TO RAISE a better crop is one thing. To sell it for an adequate price is another. To collect the price after it is agreed upon and the crop is sold is yet another, and sometimes that is the hardest part of all.

That it is essential to collect, if a man is to get anywhere with his farming, goes without saying, yet many a farmer the country over has seen a good crop go for nothing—or for a deficit if he has had to pay transportation on it.

But today a remedy is at hand, if a farmer will grow one or two good business papers along with his potatoes. If he will have a clearly written contract of sale and an inspection certificate covering his shipment, he will get his money—though even then it may take time.

Honest Dealing

A shipper in Minnesota sold a car of U. S. No. 1 size A potatoes to a dealer in Iowa. When the car arrived the buyer said he would have to reject it because the sacks were not branded U. S. No. 1 and because he thought the potatoes were not large enough. The shipper protested to the U. S. Department of Agriculture. The Department asked the broker to report by wire the terms of the sale, and the shipping-point inspection was looked into. The terms were clear and the inspection certificate showed that the sacks were new and branded and that the potatoes graded U. S. No. 1, size A. The buyer was notified of these facts and that he should accept the shipment at once. Without further delay the buyer accepted and paid the farmer the contract price of $619.20.

But the contract must be clearly stated to be of best use. A grower in Utah sold two cars of onions to a dealer in Chicago. The contract said the shipment would be made the first week of the month. When the cars arrived a dispute arose about the meaning of that time phrase in the contract and the dealer didn't want the shipment. The shipper filed a complaint with the Department, which advised the buyer that apparently the seller had made good delivery under the contract as it was worded. Thereupon the buyer paid the drafts for $630.00 covering the purchase price on both cars. The grower got his money because he had a contract and called on the Government to sustain it,

(*Turn to page* 35)

Dixie—Land of Cotton and Forests

By Lyle Brown

Extension Forester, Alabama Polytechnic Institute, Auburn, Alabama

DIXIE is not only a land of cotton, according to claims of those who are enthusiastic about the forestry future of that section. This potential forestral garden spot of the country comprises the 11 southern States from Virginia to Texas, whence came the long leaf and other yellow pines, and to which pulp and paper mills and seekers of plentiful raw wood fiber are making their way in goodly numbers.

The two foremost reasons for such claims by the sponsors of a southern forestral renaissance are that a sensible land-use program will involve forest trees for the proper protection and utilization of nearly two-thirds of the land area in the region. Favorable climatic conditions permit the production of lumber, poles, posts, staves, railroad ties, etc., and wood fiber in other forms more abundantly and cheaper than in any other section of the United States. Here the value of forests as a restraining influence on soil erosion and other destructive agencies is widely gaining recognition, as this is one of the forest's more important functions.

This region of 296 million acres, including Virginia, North Carolina, South Carolina, Georgia, Alabama, Florida, Mississippi, Arkansas, Louisiana, and eastern Texas and Oklahoma, from whose virgin timber stands a large quantity of the world's finest timber products have come, still has almost 192 million acres in woods. The proportion of practically 2 acres in woods to 1 in open land is being increased by the present trend of 3 acres turned back to forestry for every 1 cleared for agricultural purposes. Such a trend can hardly be expected to show a decrease for several years, with the present alteration of cropping systems and the soil conservation programs in vogue.

To those who are interested in the integrated uses of forests rather than monetary returns alone, it is quite evident that the topography, quality, and general condition of much of the land is going to demand a very large proportion of timber for protection against the ravages of soil erosion. Reconnaissance surveys have established the already admitted fact that upward of 75 per cent of whole States within the area is showing some degree of erosion. Unprotected areas are recorded as losing 75 to 100 tons of soil per acre per year with huge losses in water run-off, while research has recently shown that even rough lands with good forest cover properly protected from fire will show a very small water run-off and little or no actual loss of mineral soil. These facts are encouraging many land-owners to reforest by planting open lands and countless others to adopt systems of protection to encourage early natural regeneration of stands.

Large Export Business

Looking at the purely economic side of forestry in the Southeast, we find that the region is, as it always has been, a large exporter of lumber and other timber products. During the year 1936 the lumber cut in these 11 States was more than 74 billion board feet of soft-

wood, mostly yellow pine, and 21 billion board feet of hardwood.

To such figures we may add other products including the rather recently created demand for nearly 4 million cords of wood annually by pulp and paper mills. A very large portion of such business can be maintained permanently because of the high productivity of the land. While recently cutover acreages are yielding poorly now, it will require only fire protection and a few years until they will be mostly well-stocked and showing a good per-acre production, which may be ready for pulpwood or naval stores in 15 to 20 years, poles in 20 to 30 years, and sawlogs in 30 to 40 years. The better sites of the yellow pine lands will give an annual production of 400 to 500 board feet per acre, while choice sites under good management may yield more than twice that amount.

Industrially, a large number of the permanently located saw mills are adopting selective cutting methods and are working toward placing their operations on a sustained yield basis which will afford a continuous cut of timber. Smaller mills having no appreciable holdings of their own are dependent upon local production, which in many cases is adequate to sustain them, or they may move from one location to another to provide more accessible raw material.

Paper Mills Move South

The influx of pulp and paper mills into the South during recent years is a result of research which has shown that southern pines, previously considered unfit for newsprint and better grades of paper, can be used quite successfully and very economically, not only in the making of the original Kraft paper, but in the manufacture of finer quality products, which have heretofore been obtained only from spruce and other less resinous trees.

This movement of the paper industry to the South is apparently very definitely to the advantage of the industry, but it remains for time and the adoption of procurement and cutting practices by the industry to tell whether or not it is to benefit the producer of the trees which are made into these products. Doubtless, competition with each other and with other wood-using industries will force the general level of prices for

(*Turn to page* 42)

Short-leaf pine being cut for pulpwood. Good well-spaced trees are left for a future harvest of poles, piling, or saw logs.

Strike a Balance Of Soil Fertility

By R. E. Stephenson

Oregon State Agricultural College, Corvallis, Oregon

THE tonnage of commercial fertilizers used in Oregon increased 50 per cent in 10 years following 1926. The amount used at present is relatively small, 12,000 tons in 1936. Perhaps no one can state accurately the amount of fertilizer necessary to replace removal of fertility from the soil. How much fertilizer might be profitably used is also elusive of estimation.

Grain occupies a third to half the cropped land in Oregon. Small grain is mostly sold off the farm and therefore removes fertility. To replace fertility removal (N-P-K) in 20 million bushels of wheat and mixed grains produced annually would require 84,000 tons of nitrate of soda, 33,000 tons of 16 per cent superphosphate, and 6,000 tons of muriate of potash, a total of 123,000 tons or more than 10 times the fertilizer used on all the crops produced and representing a value of nearly $3,500,000. This makes no allowance for fertility removal in the straw.

We are not asking that fertilizer practice should be based upon replacement. To replace the entire fertility removal is neither necessary nor profitable. Fertilizer practice is a problem in economics. No doubt more fertilizer could be used profitably than has been used. Any reasonable attempt to draw a balance sheet, however crude, aids one's perspective, and helps to impress the reality of the problem.

In spite of better machinery, improved seed varieties, and better tillage, yields are not always maintained at former high levels, partly because the fertility balance has been given too little consideration.

Sale of crops is not the only cause for loss of fertility. Even when crops are fed, there is ample opportunity for fertility losses. According to estimates, Oregon livestock produce about $25,000,000 worth of manure annually, based upon fertilizer values. The careless methods of handling and unpreventable causes result in losses of one-fourth or more of the fertility. A conservative estimate would place $6,000,000 as the loss of fertility value of the animal manures. This is more than the removal of fertility in grain sold, and would require 200,000 tons of commercial fertilizer to replace.

Unavoidable Losses

There would be some loss of fertility on the stock farm, even if all the fertility of the manure could be saved. Sale of animals and animal products, such as milk, removes fertility. The usual figure is 10 to 20 per cent of the fertility value of the feed consumed retained by the animal. This would represent perhaps $2,500,000 worth of fertility, or an amount several times the fertilizer purchased.

Still other fertility losses are not made good. According to estimates by Lipman, the average crop removal loss is about one-third the total. A nearly equal amount of fertility is lost by leaching of soluble plant food and by erosion of the rich topsoil. Oregon has approximately 4,000,000 acres of crop

(*Turn to page* 38)

Everett Troyer of Laotto, Indiana, State Champion in 1937, grew the Katahdin variety of potato.

Quality Potatoes From Muck Soils

By N. Kent Ellis

Department of Horticulture, Purdue University, Lafayette, Indiana

WITHOUT question, the greatest amount of high-quality, well-packed, Indiana-grown potatoes reaching the markets today is grown on muck soil. The acreage of muck-grown potatoes in Indiana has increased in the last 10 years, and with the present favorable outlook, as far as production is concerned, it is likely to continue.

With increased knowledge in fertilizer practices, and still more recent the introduction of newer varieties, the grower no longer is ashamed to say "certainly these are muck grown." The old prejudices against potatoes grown on muck soils are rapidly being broken down.

In Indiana the term "muck" is used broadly to denote all organic soils, from those containing a high percentage of mineral to the very raw and fibrous peats. Potatoes do well over a wide range of different soils, provided the reaction of the soil is suitable to potato production. High yields are not possible under alkaline conditions, that is with the pH at 7.5 or above, although scab is not likely to be present. With the soil reaction at about the neutral point (pH 7), potato production is not advisable due to frequency of scab in these soils, even though the yields are satisfactory. The mucks best suited to potato production are those having a pH of about 5.2. Excellent crops of potatoes are grown on very acid mucks

with pH down to 4.4. At this reaction the yields are decreased, but the tubers are likely to be free from disease. As the numerical pH value approaches 7, the probability is greater that the percentage of No. 1 potatoes will be less. On these soils the alkaline (or sweet) condition can be corrected by the application of sulfur flour. The application will range from 500-2,000 pounds per acre, depending on the alkalinity. On soils which are too acid (or sour) limestone can be applied to sweeten the soil, but potatoes should not be grown on the field immediately following the lime application. The grower should have soil tests made and have his county agent or State experiment station make suitable recommendations.

Field Preparation

The best potato soils are those on which the water level can be maintained at 30-36 inches below the surface. Soils which are too wet, and particularly very acid soils which are wet, will not produce good yields. It is essential, however, that the soil remain moist throughout the season, thus helping to prevent scab and protect the field from frost.

Plowing may be done either in the fall or spring, depending on whether or not a green manure crop is being used, and on the age of the muck area. In either case the plowing should be deep, 8-12 inches. This will afford a deep seed bed. For soils which have been in production for many years, it is recommended that rye be drilled in as early as possible in the fall and left standing over winter to protect the land from blowing. It can then be turned under in the spring when it has reached a height of about 10-12 inches. This will cause the soil to be loose, and unless there is much rain, the land should be well packed by means of a cultipacker or heavy concrete roller. Areas which are well protected from wind can be plowed in the fall, which will allow the field to be worked earlier in the spring and will require less packing. Where soils are raw and it is desirable to weather them more rapidly, fall plowing is recommended. This affords a finer seed bed for the crop.

The proper fertilization of a potato crop on muck ranks in equal importance to the selection of good seed. The fertilizer element most essential for producing a good crop is potassium. In the fertilizer mixture, the second greatest need is phosphate. Nitrogen seldom pays for itself when added to the fertilizer for potatoes, except under abnormally cold and wet conditions in the spring or on very acid soils.

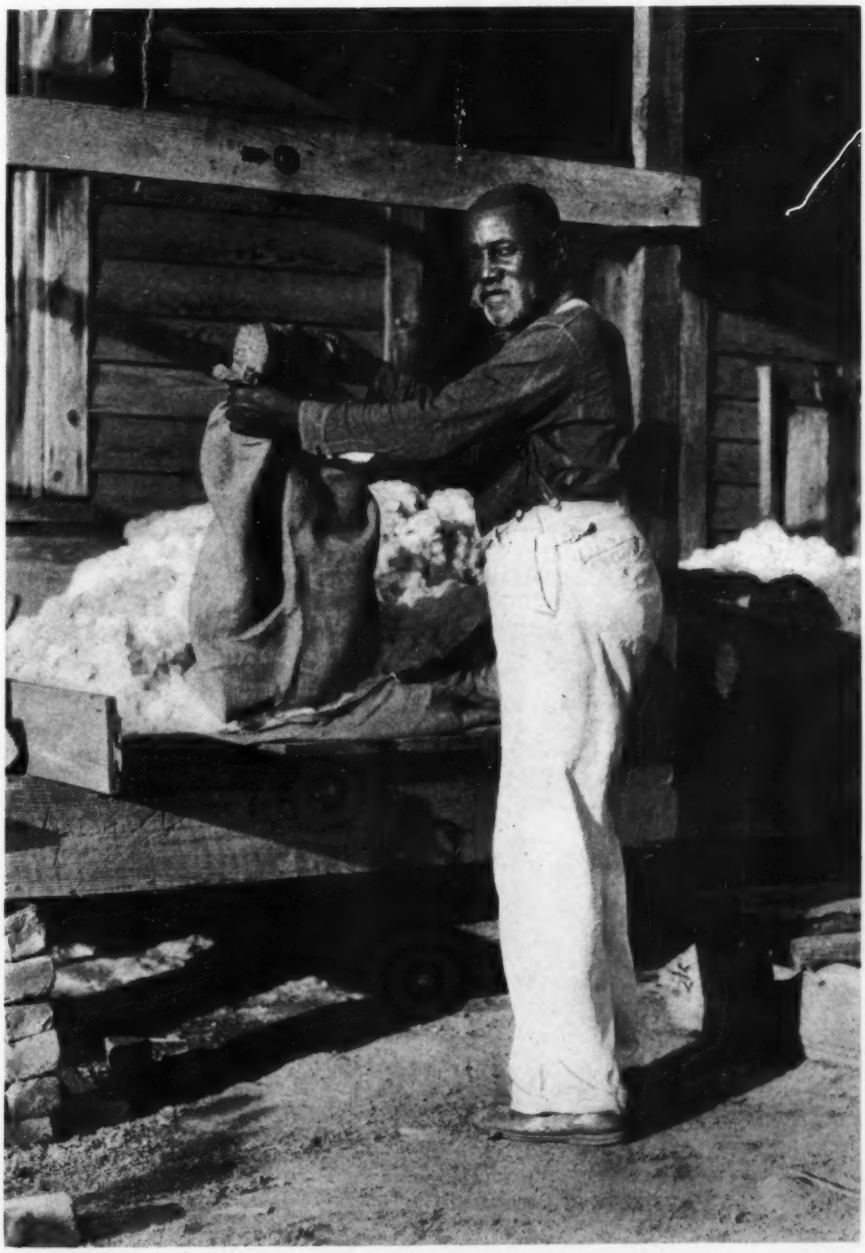
The following table is a progress report on the 1937 yields of Cobbler potatoes from Purdue's Northern Indiana Muck Crops Experimental Farm. The data are averages of duplicate plots, except the check and the 0-8-24 controls which are each replicated six times. Fertilizer was used at the rate of 1,000 pounds per acre on each plot.

From these data it is seen that potash gives the greatest return on the investment. The equivalent of 480 pounds of muriate of potash returned 121 bushels of potatoes per acre over the unfertilized plot. Eight per cent phosphate returned 48 bushels over the untreated plot. The combination of the above two treatments increased the yield 151 bushels over the unfertilized. Greater potash applications increased the yield, but increases above 480 pounds of muriate of potash were not profitable to the grower, unless the price of potatoes was above $1 per bushel. Also, to pay for increases in the application of phosphate above 80 pounds of phosphoric acid as in 0-24-24 over 0-8-24, the price of potatoes must remain above $1 per bushel.

From the standpoint of economy, the proper placement of fertilizer is especially important. Data from the 1937 fertilizer placement plots at the Northern Indiana Muck Crops Experimental Farm bear this out. During 1937 the yields from the 500- and 1,000-pound broadcast applications were the same. The 250-pound treatment beside the seed in bands, and 500 pounds below

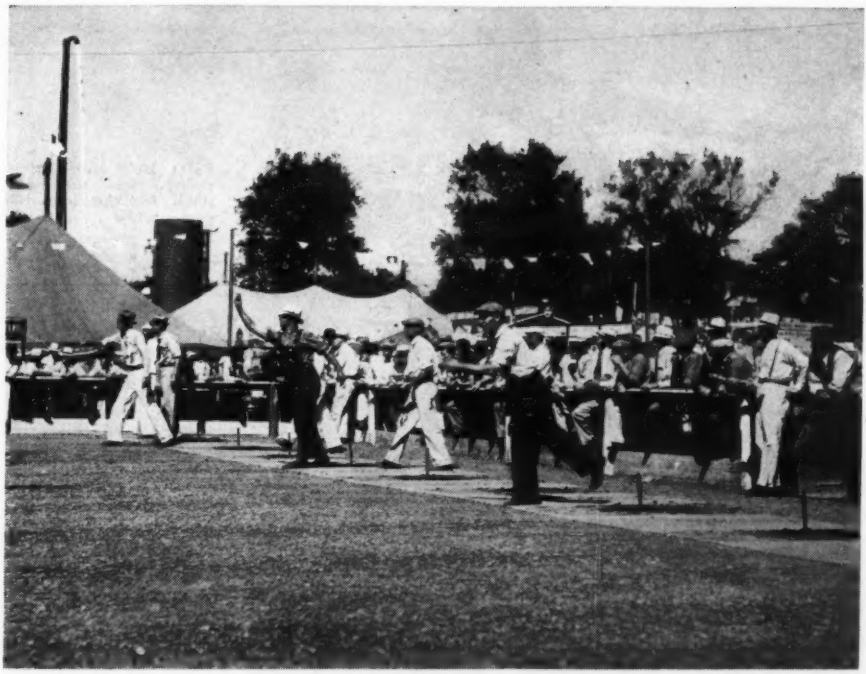
(*Turn to page* 44)

PICTORIAL



Pleased with his pickin's

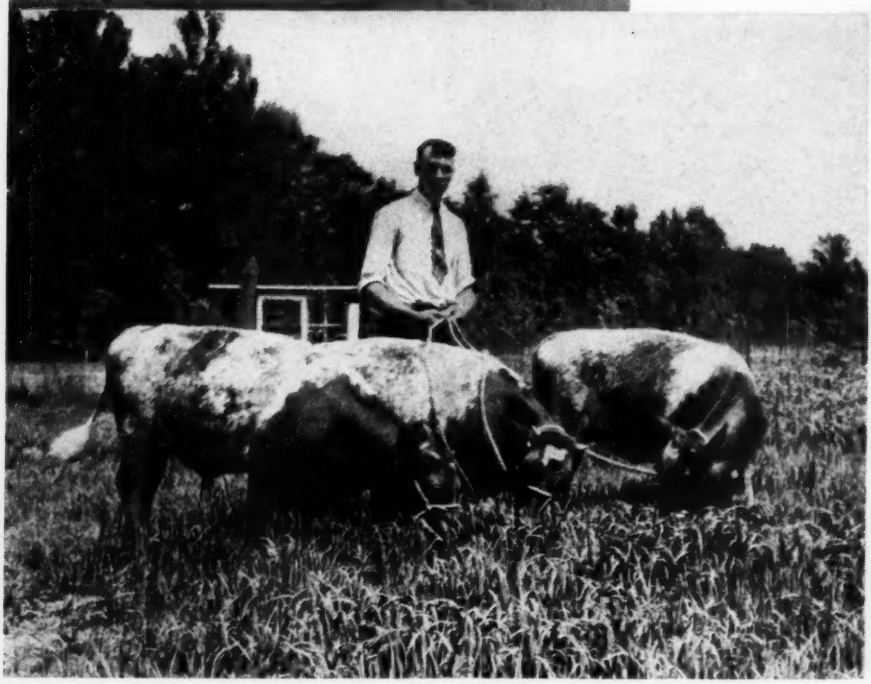
Behind the Scenes



On the Midway]

Left: He's still sitting pretty, but the real thrill for the audience comes when . . . .

Below: Three shorthorns born on the farm of John Petrie, Grafton, N. S., Canada, were the second known set of triplet calves in North America.



The Editors Talk

Fertilizers Go West

Usually we think of the West as the country of the great open spaces, mountains, grazing ranges, and cattle. But, as in other regions, changes in agriculture are taking place. In the 11 western States 11,412,789 acres of farm land are now irrigated which, according to the U. S. census for 1934, comprise 87.6% of the irrigated area of the United States.

On some of this acreage in each of the western States, fertilizers are now used. This is a marked change to even a few years ago, when in some States little if any plant food was applied. It is estimated that the total of all fertilizer usage in this area and British Columbia in 1937 was 307,935 tons, which contained some 10,580 tons of actual potash. About 78% of this total tonnage was used in California, but it is significant that fertilizers are now used in the other States to some extent and that the interest in fertilizers is growing, as in Idaho for instance, where a fertilizer mixing and distributing system is being established.

In addition to the irrigated acreage there are, of course, large acreages of crops where irrigation is not practiced. Rainfall varies over a very wide range. Vast areas are in cattle ranges; some crops are produced by dry-land farming; and in other regions, as in the western part of Washington, the rainfall is sufficient for the successful use of fertilizers without irrigation. But taken as a whole the water supply "on tap" for crop production is the life stream that produces much of the more important specialized farm crops, such as fruits, both citrus and deciduous, vegetables, and sugar beets.

Research on soil and fertilization problems is an increasing activity of the State agricultural colleges and experiment stations of the region. Each has its own special problems to contend with in relation to its particular types of soil, climate, and crop production. Fundamental, however, to much other work on soils and fertilizers is the determination of how much plant food is available in the more important agricultural soil types. In such determinations biological and chemical methods are used. In addition to field work, representative samples of the chief types are taken from the field for more intensive studies under controlled conditions at research centers. Thus an inventory of present soil fertility levels and the location of areas of possible nutrient deficiencies in soils are being obtained. Such information is basic to efficient fertilizer use and to the prevention of soil nutrient depletion.

The West is also a region of large crop and fertilizer distributing organizations that in many cases maintain trained agricultural staffs which are contributing their share to the work on plant food. Among such units are the fruit and vegetable canning and packing companies, growers cooperatives, the large sugar beet companies, fertilizer materials companies and the fertilizer trade which maintain an active and organized interest in the solution of soil fertility problems.

Because of the mountainous nature of the country the distance between com-

mercial crop producing areas is often great. Under such conditions to spread the load and reduce the time lag, understanding and cooperation between such agricultural organizations and the State agricultural authorities are highly desirable and increasingly the tendency. While the use of fertilizers in many parts of the West is quite new, because plant food is being removed by specialized crops in large quantities, it is inevitable that fertilizer consumption in the commercial crop producing areas will ultimately increase. Efficient fertilizer use and crop production in the future depend upon the soil fertility work being done today and upon the cooperation of all concerned.

"Ask the Plant"

In July the Plant Food Research Committee of the fertilizer industry made a tour of Indiana and Illinois to study the results of experimental work with fertilizers in these States. As noted in an excellent account of the tour by Joe Bumgarner in the *Prairie Farmer,* the soil scientists came to ask the plant how it was faring.

"We are asking the plant: 'What are you getting from the soil?'" said one of the hosts of the party. "Plant breeders are developing better soil mining machinery every year. Farming is a chemical operation. Fertilizer treatments must be planned to take advantage of the better mining machinery in hybrid corn and new varieties of other grains."

As an aid to determining plant-food deficiencies, rapid chemical tests have been developed. The testing kit originally designed by Professor S. F. Thornton at Purdue has been offered to agricultural teachers, county agents, and other competent workers in Indiana. About 1,000 kits have been distributed and more than 100,000 soil samples tested. As these tests for plants are perfected and agricultural workers become conversant with the technique, then such tests will doubtless be of great value.

The effect of fertilizers on the Hopkins Poorland Farm, Marion County, Illinois, was noted with much interest. It will be recalled that Dr. Cyril G. Hopkins selected the poorest farm on a soil type common to south-central Illinois. The original system of farming on this land featured liming, legume rotation, application of organic matter, and the use of rock phosphate. Within recent years symptoms of potash deficiency have appeared on many of the crops grown in southern Illinois. At the present time at Poorland farm, applications of commercial fertilizers containing phosphorus and potash (analyzing 0-8-24) double the yields. On the soils of this farm, Dr. E. E. DeTurk of the University of Illinois pointed out, the plants are unable to draw on the relatively unsoluble feldspar for enough available potash to meet plant needs even though the total of the potash in the soil is high. "We recognize throughout this region a definite deficiency of potassium and phosphorus," said Dr. DeTurk. "Flat prairie soils of southern Illinois need lime, legumes, organic matter, phosphate, and potash."

At other farms, in order to find the effect of fertilizers in large quantities, heavy applications of fertilizers have been made up to 6,800 pounds per acre as an initial treatment. This is purely an experiment to determine the effect of available plant food in the rotation of the crop that follows. Initial results show that relatively poor soil can be changed into land that yields 3.6 tons of red clover from the first cutting.

The tour emphasized that as efficiency in crop production develops, so must efficiency in the use of fertilizers keep pace with it. Many problems yet remain to be solved. Probably we shall be asking the hungry plant for years to come.

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture and the State Experiment Stations relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizer

¶ "Fertilizers, What They Are and How to Use Them," Michigan Agricultural Experiment Station Special Bulletin 133 (Revised in March, 1938), by C. E. Millar and L. M. Turk, is a most comprehensive publication dealing with the basic principles concerning fertilizer usage in the maintenance of soil productivity and in building up depleted soils. As in the original bulletin issued in 1924, the authors present pertinent information on the plant-food requirements of plants, the quantity of nutrients contained in different crops, the sources of fertilizer materials, time, rate, and method of application, and the effects of fertilizers on soils and crops. Based on the newer concepts of commercial fertilizer gained from more extensive research, a much broader treatment of the above subjects is given in the revised edition.

Because of the many factors other than soluble plant nutrients which affect plant growth, such as rainfall, drainage, temperature, rotation, and previous soil treatment, the problem of determining in the laboratory the kind of fertilizer best suited for the soil is difficult. In selecting the fertilizer reference to the results of field experiments should be made. The rapid chemical tests serve as a useful guide in determining fertilizer needs of soils, but the authors state that sole reliance should not be placed on them.

After many years of experimental research, the Soils Department of this Station has determined that 16 fertilizer grades in addition to potash and nitrogen materials will meet the requirements of all crops in Michigan. Fertilizers containing less than 20% plant food are not recommended because of higher cost per pound of plant food. The authors advise that a high analysis fertilizer which meets the individual soil and crop requirements is the most economical, since a greater portion of the purchase price goes to pay for plant food. In this connection it is interesting to note from a table in the bulletin, giving the sales of fertilizer in Michigan in recent years, that the formerly popular low-grade analyses are steadily decreasing in sales, being replaced by the recommended grades. An outstanding example of this is the 2-12-2, containing only 14 per cent plant food, which constituted 16.9 per cent of total sales in 1928 as compared with 7.5 per cent in 1937. This grade is being supplanted largely by the 2-12-6 analysis, which showed an increase in total sales of from 13 per cent in 1928 to 44.9 per cent in 1937. This trend shows the value of scientific investigations carried on by experiment stations on the more efficient use of fertilizers and elimination of unnecessary grades that add considerably to fertilizer production costs. The contents of this bulletin will be of interest to all desiring general information on commercial fertilizers.

"Fertilizers for Potatoes (Third Report)," Agr. Exp. Sta., Storrs, Conn., Bul. 223, Apr. 1938, B. A. Brown.

"Information Sheets, 1935 to 1938," Agr. Exp. Sta., State College, Miss., Vol. 111, 101-150.

"What Fertilizer for Wheat," Cornell Univ. Agr. Ext. Serv., Ithaca, N. Y., Mimeo. 460, June 8, 1938, E. L. Worthon.

"Fertilizers Recommended for Field Crops," Agr. Exp. Sta., State College, Penna., Oct. 1937.

"Fertilizers for Tennessee Soils," Agr. Exp. Sta., Knoxville, Tenn., Cir. 60, Apr. 1938, C. A. Mooers.

"Suggested Fertilizers for West Virginia Farms," Agr. Ext. Serv., Morgantown, W. Va.

"Influence of Farm Manure on Yields and Sucrose of Sugar Beets," U. S. D. A., Washington, D. C., Tech. Bul. 614, Mar. 1938, Stephen H. Hastings, S. B. Nuckols, Lionel Harris.

Soils

¶ Supported by a volume of data obtained from 28 years of experimentation to determine crop responses under varying systems of soil treatment, G. L. Schuster and C. E. Phillips in Delaware Agricultural Experiment Station Bulletin 209, entitled "Fertility Experiments on Sassafras Silt Loam," draw numerous important conclusions as to the fertilization of crops grown on this major soil type. The experiments were laid out in 1907 and carried through the 1935 crop season, but the authors interpret the data on the basis of two periods.

The first 15 years' results were reported in 1924 in Station Bulletin 137, the conclusions from which are quoted in the current publication. Summarizing these results, the authors state that potassium was the limiting factor in the production of corn and soybeans under the condition of these experiments. The limiting factor in the production of wheat and hay was phosphoric acid. It was determined that phosphoric acid-potash combination was almost equally as good as a complete fertilizer for all crops. Applications of manure for corn production were equally as good, if not better than a complete fertilizer. Corn or soybean yields were not increased by lime, except where potash was applied. Favorable results were obtained from lime on the hay crop; however, the greatest gains were made when lime was used in connection with phosphoric acid.

While the rotation of (1) corn followed by a cover crop of rye and vetch, (2) soybeans, (3) wheat and, (4) timothy and clover was continued throughout the studies, the soil treatment was modified somewhat at the beginning of the second period. It was believed that a larger quantity of plant nutrients had been supplied in the initial experiment than the plants could economically utilize. The quantity applied during the latter period was reduced from 50 to 75 per cent of that used at first.

A comparison of the yield trends portrayed graphically in the several charts given in this bulletin shows that the liberal use of plant nutrients was necessary to produce and maintain maximum yields. Furthermore, any marked decrease in the amount of plant nutrients was inevitably followed by a marked decline in yields.

"Relation of Soil Reaction to Strawberry Production in Central Florida," Agr. Exp. Sta., Gainesville, Fla., Press Bul. 513, June 1938, A. N. Brooks.

"Subirrigation," Agr. Ext. Serv., Gainesville, Fla., Bul. 99 (Revision of Bul. 5), June 1938, A. P. Spencer.

"Soil Conservation in Indiana," Agr. Ext. Serv., Lafayette, Ind., Ext. Bul. 228, June 1938, R. O. Cole.

"Soil Fertility Investigations Brown Limestone Land of Southwestern Missouri," Agr. Exp. Sta., Columbia, Mo., Bul. 395, June 1938, H. H. Krusekopf.

"Soil Fertility Investigations Rolling Prairie Land of Southwestern Missouri," Agr. Exp. Sta., Columbia, Mo., Bul. 396, June 1938, H. H. Krusekopf.

"The Effect of the Degree of Slope and Rainfall Characteristics on Runoff and Soil Erosion," Agr. Exp. Sta., Columbia, Mo., Res. Bul. 280, Apr. 1938, Jesse H. Neal.

"A Proposed Method for Classifying and Evaluating Soils on the Basis of Productivity and Use Suitabilities," Agr. Exp. Sta., Lincoln, Nebr., Res. Bul. 98, May 1938, Arthur Anderson, A. P. Nelson, F. A. Hayes, and I. D. Wood.

"The Chemical Content of Oklahoma Rainfall," Agr. Exp. Sta., Stillwater, Okla., Tech. Bul. No. 1, May 1938, V. G. Heller.

"Progress in Soil Conservation Research," Agr. Exp. Sta., College Station, Brazos County, Tex., Prog. Report 498, Jan. 12, 1938, P. R. Johnson.

"No Farmer Is Richer Than His Soil," (How to Build Your Soil Wealth With the Nation's Aid), Agr. Ext. Serv., Morgantown, W. Va., J. O. Knapp, Director.

"Erosion and Its Control in Oklahoma Territory," U. S. D. A., Washington, D. C., Misc. Pub. 301, Mar. 1938, Angus McDonald.

"Soil Conservation: Who Gains By It?", U. S. D. A., AAA, Washington, D. C., DS-11, Oct. 1937.

Crops

¶ A timely publication giving valuable information on growing Indiana's leading cash crop is Purdue Agricultural Experiment Station Circular 237, "Wheat Production in Indiana," by A. T. Wiancko and C. E. Skiver. Not only is wheat important for its cash return, but it lends itself to the seeding of clover and grass crops desired to round out the rotation. With a good variety, good seed, proper attention to cultural requirements, and appropriate fertilization, profitable yields can be raised in all parts of the State, the authors reveal.

The "soft red winter" type is ideally suited to the climatic conditions that prevail in Indiana. Purdue No. 1, Fultz, Trumbull, and Michigan Amber varieties are among those most extensively grown. Seed wheat should be carefully selected, cleaned, and graded. The seed bed for wheat should be fine but firm, with about 2 inches of loose soil on top to cover the seed. The authors recommend the seeding of 6 pecks per acre for normal conditions, and somewhat larger amounts for very late seeding. They state, however, that wheat should be sown as soon as possible, when freedom from Hessian Fly infestation is reasonably assured. The control of certain weeds is very essential. Weeds, such as cockle, vetch, and wild garlic, particularly injure quality of the flour produced.

In fertilizing wheat, special consideration to the phosphate and potash requirements of the clover or hay crop following it in the rotation is advised. From 200 to 400 pounds of 2-12-6 or similar analyses are recommended. A top-dressing with a soluble nitrogen fertilizer in early spring has been found profitable on soils that contain insufficient nitrates.

"Forty-ninth Annual Report, Fiscal Year Ending June 30, 1937," Agr. Exp. Sta., Fayetteville, Ark., Bul. 351, Mar. 1938, C. O. Brannen.

"Annual Report of Extension Service, Fiscal Year July 1, 1936 to June 30, 1937, With Report of Field Activities December 1, 1936 to November 30, 1937," Agr. Ext. Serv., Little Rock, Ark., Ext. Cir. 405, Feb. 1938.

"Accomplishments of the Colorado Experiment Station," Agr. Exp. Sta., Fort Collins, Colo., Jan. 1, 1937.

"Planting and Maintaining Colorado Lawns," Agr. Exp. Sta., Fort Collins, Colo., Bul. 442, Mar. 1938, George Beach.

"Strawberry Culture in Connecticut," Agr. Ext. Serv., Storrs, Conn., Bul. 263, Revision of 167, Apr. 1938, H. A. Rollins.

"Report of the Director for the Year Ending June 30, 1937," Agr. Exp. Sta., Storrs, Conn., Bul. 221, Nov. 1937, William L. Slate, Director.

"Report of the Director for the Year Ending October 31, 1937," Agr. Exp. Sta., New Haven, Conn., Bul. 409, Apr. 1938, William L. Slate, Director.

"Tobacco Substation at Windsor, Report for 1937," Agr. Exp. Sta., New Haven, Conn., Bul. 410, Apr. 1938, P. J. Anderson, T. R. Swanback, and O. E. Street.

"Catalog of the Official Publications of the Florida Agricultural Experiment Station and Florida Agricultural Extension Service 1888-1937," Agr. Exp. Sta., Gainesville, Fla., May 1938, Ida Keeling Cresap.

"1937 Report Cooperative Extension Work in Agriculture and Home Economics, Report of General Activities for 1937 with Financial Statement for the Fiscal Year Ended June 30, 1937," Agr. Ext. Serv., Gainesville, Fla., Wilmon Newell, Director.

"Ornamental Trees," Agr. Ext. Serv., Gainesville, Fla., Bul. 95, Apr. 1938, Harold Mowry.

"Citrus Propagation," Agr. Ext. Serv., Gainesville, Fla., Bul. 96, May 1938, A. F. Camp.

"Seventeenth Annual Report 1936-1937, Crop Yields Shown for Calendar Year 1936," Ga. Coastal Plain Exp. Sta., Tifton, Ga., Bul. 28, S. H. Starr, Director.

"A Study of Soybean Varieties With Reference to Their Use As Food," Agr. Exp. Sta., Urbana, Ill., Bul. 443, May 1938, Sybil Woodruff and Helen Klaas.

"Combating Corn Diseases," Agr. Ext. Serv., Urbana, Ill., Cir. 484, Mar. 1938, Benjamin Koehler and James R. Holbert.

"Report of the Director for the Year Ending June 30, 1937," Agr. Exp. Sta., Lafayette, Ind., J. H. Skinner, Director.

"Pasture Improvement in Indiana," Agr. Ext. Serv., Lafayette, Ind., Ext. Bul. (Revised) 205, May 1938, K. E. Beeson and M. O. Pence.

"Tree Windbreaks for Indiana Farms," Agr. Ext. Serv., Lafayette, Ind., Ext. Bul. 226, Feb. 1938, Daniel DenUyl.

"Soybeans in Indiana," Agr. Ext. Serv., Lafayette, Ind., Ext. Bul 231, May 1938, K. E. Beeson.

"Fiftieth Annual Report of the Agricultural Experiment Station of the University of Kentucky, Part 11, Bulletins 368-377, Circulars 46-48," Agr. Exp. Sta., Lexington, Ky., Bul. 368, Mar. 1937.

"Fifty-third Annual Report of the Maine Agricultural Experiment Station, 1936-1937," Agr. Exp. Sta., Orono, Maine.

"Maine Fruit Notes," Agr. Ext. Serv., Orono, Maine, Vol. 12, No. 2, Apr. 1938, A. K. Gardner and O. L. Wyman.

"Forty-ninth Annual Report of the University of Maryland Agricultural Experiment Station," Agr. Exp. Sta., College Park, Prince George's County, Md., Vol. 49, 1935-1936.

"Fiftieth Annual Report of the University of Maryland Agricultural Experiment Station," Agr. Exp. Sta., College Park, Prince George's County, Md., Vol. 50, 1936-1937.

"Annual Report for the Fiscal Year Ending November 30, 1937," Agr. Exp. Sta., Amherst, Mass., Bul. 347, Mar. 1938.

"The Massachusetts Commercial Vegetable Grower," Agr. Ext. Service, Amherst, Mass., No. 12, June 1938.

"Fruit Notes," Agr. Ext. Serv., Amherst, Mass., Apr. 1938, W. H. Thies.

"Seventy-sixth Annual Report of the Secretary of the State Board of Agriculture of the State of Michigan and Fiftieth Annual Report of the Experiment Station from July 1, 1936 to June 30, 1937," Agr. Exp. Sta., Lansing, Mich., 1937.

"Alfalfa Management With Special Reference to Fall Treatment," Agr. Exp. Sta., East Lansing, Mich., Sp. Bul. 292, May 1938, H. C. Rather and C. M. Harrison.

"The Quarterly Bulletin," Agr. Exp. Sta., East Lansing, Mich, Vol. 20, No. 4 and Supplement to No. 4, May 1938.

"Growing Strawberries in Missouri," Agr. Exp. Sta., Columbia, Mo., Cir. 198, May 1938, T. J. Talbert.

"Fifty-first Annual Report of the Agricultural Experiment Station of Nebraska," Agr. Exp. Sta., Lincoln, Nebr., Feb. 1, 1938.

"Grain and Forage Sorghums in Nebraska," Agr. Exp. Sta., Lincoln, Nebr., Bul 316, April 1938, T. A. Kiesselbach, R. L. Cushing, and E. F. Frolik.

"Seeding and Management of Nebraska Pastures," Agr. Ext. Serv., Lincoln, Nebr., Ext. Cir. 138, Mar. 1938, A. L. Frolik and E. F. Frolik.

"Winter Wheat Production Costs, Nebraska, 1937, Six Counties, Cass, Douglas, Saunders, Fillmore, Perkins, Cheyenne," Agr. Ext. Serv., Lincoln, Nebr., Ext. Cir. 839, Jan. 1938, Arthur G. George.

"Corn Production Costs Nebraska 1937, Nine Counties, Cass, Douglas, Saunders, Fillmore, Phelps, Thurston, Cuming, Washington, Burt," Agr. Ext. Serv., Lincoln, Nebr., Ext. Cir. 840, Feb. 1938, Arthur G. George.

"Twenty-second Annual Report of the New Jersey State Department of Agriculture, July 1, 1936-June 30, 1937," Dept. of Agr., Trenton, N. J., William B. Duryee, Sec.

"Potato Diseases and Their Control," Cornell Agr. Ext. Serv., Ithaca, N. Y., Bul. 135 (Revised June 1937), Mar. 1926, M. F. Barrus and Charles Chupp.

"The Home Garden," Cornell Agr. Ext. Serv., Ithaca, N. Y., Bul. 344 (Revised Dec. 1937), Mar. 1936, Arthur J. Pratt.

"Progress of Agricultural Research in Ohio, 1936-1937," Agr. Exp. Sta., Wooster, Ohio, Bul. 592, May 1938.

"The Bimonthly Bulletin," Agr. Exp. Sta., Wooster, Ohio, Vol. XXIII, No. 192, May-June 1938.

"Clovers and Grasses for Hay and Pasture," Agr. Exp. Sta., Knoxville, Tenn., Bul. 165, Mar. 1938, C. A. Mooers.

"Maturity Studies of Marsh Seedless Grapefruit in the Lower Rio Grande Valley," Agr. Exp. Sta., College Station, Brazos County, Tex., Bul. 562, May 1938, J. F. Wood and Harold M. Reed.

"Recent Developments in Agronomy," Agr. Exp. Sta., College Station, Brazos County, Tex., Prog. Report 494, Jan. 11, 1938, E. B. Reynolds, Chief.

"Agricultural Research Aids Industrial Development," Agr. Exp. Sta., College Station, Brazos County, Tex., Prog. Report 495, Mar. 18, 1938, A. D. Jackson, Chief.

"Texas Research on Pasture Development," Agr. Exp. Sta., College Station, Brazos County, Tex., Prog. Report 499, Jan. 12, 1938, R. L. Hensel.

"1937 Results of Sugar Cane Studies Conducted at Lufkin," Agr. Exp. Sta., College Station, Brazos County, Tex., Prog. Report 504, Feb. 16, 1938, E. K. Grouch.

"Annual Report of the John Tarleton Agricultural College for the Fiscal Year 1936-1937," John Tarleton Agr. Col. Bul., Stephenville, Tex., Vol. XXI, No. 3, Nov. 15, 1937.

"Four Pasture Clovers," Agr. Exp. Sta., Burlington, Vt., Bul. 431, Mar. 1938, A. R. Midgley.

"Department of Agriculture-Immigration of Virginia," Richmond, Va., Bul. 359, May 1938, Bul. 360, June 1938, Bul. 361, July 1938.

"Western Washington Pastures," Agr. Ext. Serv., Pullman, Wash., Ext. Bul. 155 (Revised), Mar. 1938, Leonard Hegnauer.

"The Home Garden," Agr. Ext. Serv., Morgantown, W. Va., Cir. 317, Mar. 1937, A. L. Keller and K. C. Westover.

"Ginning Cotton," U. S. D. A., Washington, D. C., Farmers' Bul. 1748, Aug. 1935, Charles A. Bennett and F. L. Gerdes.

"Forest Farming," U. S. D. A., Washington, D. C., Farmers' Bul. 1794, Apr. 1938.

"List of Bulletins of the Agricultural Experiment Stations for the Calendar Years 1935 and 1936," U. S. D. A., Washington, D. C., Misc. Pub. 294, Mar. 1938, Catherine E. Pennington.

"Production of Water Cress," U. S. D. A., Washington, D. C., Leaf. 134, Feb. 1938, J. H. Beattie.

"Production of Radishes," U. S. D. A., Washington, D. C., Leaf. 157, Mar. 1938, J. H. Beattie and W. R. Beattie.

"Rules and Recommendations for Testing Seeds," U. S. D. A., Washington, D. C., Cir. 480, July 1938.

"Plans Versus Projects," U. S. D. A., Washington, D. C., Ext. Serv. Cir. 268, July 1937, H. W. Hochbaum.

Economics

¶ The interesting fertilizer report, "Tonnages of Different Grades of Fertilizers Sold in Michigan, 1937," compiled by the Soils Department of Michigan State College is an example of what can be accomplished through cooperation of colleges and experiment stations with the fertilizer industry. Since Michigan has no compulsory law requiring tonnage reports from the companies doing business in the State, the compilation is wholly from voluntary reports submitted by the fertilizer companies. The report is in detail sufficient for a rather comprehensive analysis. In 1937 the total tonnage sold in the State was 144,500 tons, of which, 121,739 tons were mixed goods and the balance was made up largely of superphosphate and nitrogenous materials. Fall sales accounted for 51,925 tons, and 92,574 tons were sold in the spring. The leading single analysis was 2-12-6, representing practically 45% of all sales. About 81% of the total sales were composed of grades or ratios recommended by the Soils Department of the State College. Approximately 86% of the total sales of mixed goods contained 20% or more of plant food. In 1934, 73% contained over 20% plant food; in 1935, 78%; and in 1936, 81%, thus showing the gradual trend toward higher analysis fertilizers. The increase in sales over 1936 was 15%. About 80% of the total sales was made up of 10 grades. The only change in the 10 leading grades in 1937 was the replacement of sulfate of ammonia and 0-16-0 by 5-10-5 and 0-8-24. The 10 leading grades in the order of their importance were 2-12-6, 0-20-0, 2-12-2, 2-8-16, 4-16-4, 2-16-8, 4-8-6, 5-10-5, 0-8-24, and 0-10-10. The 2-12-6 registered an increase of 24.6% in sales over 1936 as compared to 21% for 0-20-0, 23.6% for 0-8-24, and 19% for 5-10-5, whereas there was practically no change in sales of 2-8-16 and 2-16-8. The 2-12-2 decreased 15% and 0-16-0 lost 67.7%.

¶ According to the report of State Chemist H. R. Kraybill in Purdue Agricultural Experiment Station Circular 235 "Commercial Fertilizers," 1937 was a banner year for fertilizer business in Indiana. The only year in which all fertilizers sold were higher was in 1929 when 291,000 tons were consumed by Indiana farmers. In 1937 the consumption figure based on sales was 274,640 tons. The leading single analysis sold in the State was 2-12-6 of which 123,332 tons were sold, and is followed by 0-20-0 representing 15,297 tons. Next in importance is 2-12-2 with 14,769 tons, and in fourth place is 0-12-12 with 12,219 tons. Plant food contained in the fertilizer sold in Indiana was 5,837 tons of N, 36,530 tons of available phosphoric acid, and 23,534 tons of K_2O. These tonnages compare to the other peak year, 1929, of 5,979 tons of N, 39,853 tons of available phosphoric acid, and 18,360 tons of K_2O.

¶ According to the fertilizer report of the California State Department of Agriculture, a total of 231,570 tons of commercial fertilizers were sold in that State in 1937, an increase of 104,272 tons from the 1932 tonnage of 127,298. Mixed goods represented 79,266 tons of the 1937 total, showing an increase of 45,731 tons over the 33,535 tons sold in 1932. A detailed analysis of the grades of mixed fertilizers sold is not reported, thus it is impossible to estimate the relative importance of the different grades.

"Citrus Enterprise-efficiency Studies in Southern California," Agr. Exp. Sta., Berkeley, Calif., Bul. 620, May 1938, Arthur Shultis.

"Commercial Fertilizers as Reported to Date for Quarter Ended March 31, 1938," Dept. of Agr., Sacramento, Calif., June 27, 1938, A. A. Brock, Director.

"Lemon Production Cost Analysis Orange County, 1937, Twelve Year Summary, 1926-1937," Agr. Ext. Serv., Berkeley, Calif.

"1937 Orange County Avocado Production Cost Analysis, Eight Year Summary 1930-1937," Agr. Ext. Serv., Berkeley, Calif.

"Valencia Production Cost Analysis Orange County 1937, Twelve Year Summary 1926-1937," Agr. Ext. Serv., Berkeley, Calif.

"Indiana Crops and Livestock," Agr. Exp. Sta., West Lafayette, Ind., Nos. 153 and 154, June 1, 1938 and July 1, 1938.

"Taking Inventory and Planning the Farm Business for Next Year 19—," Agr. Ext. Serv., Lafayette, Ind., Ext. Bul. 229, May 1938.

"Tonnage of Fertilizers Reported by Manufacturers as Shipped to Kansas During 1936,"

St. Bd. of Agr., Control Division, Topeka, Kans,. Paul Ijams, Director.

"Farm Economic Facts," Agr. Ext. Serv., Amherst, Mass., Vol. XI, No. 5, May-June 1938.

"Crop Report for Michigan," June 1938 and July 1938, Dept. of Agr., Lansing, Mich.

"District Indexes of Prices, Quantities, and Values of Cash Sales of Minnesota Farm Products," Agr. Exp. Sta., University Farm, St. Paul, Minn., Bul. 335, Dec. 1937, W. B. Garver and W. C. Waite.

"Minnesota Farm Business Notes, The Trend in Sale Prices of Farm Real Estate in Minnesota," Agr. Ext. Serv., University Farm, St. Paul, Minn., No. 186, June 20, 1938, A. A. Dowell.

"Types of Farming in Missouri," Agr. Exp. Sta., Columbia, Mo., Res. Bul. 284, May 1938, Conrad H. Hammar, Walter J. Roth, and O. R. Johnson.

"Agriculture on the Flathead Project," Agr. Exp. Sta., Bozeman, Mont., Bul. 357, Apr. 1938, P. L. Slagsvold and J. D. Mathews.

"The New York State 1938 Agricultural Outlook," Cornell Univ. Agr. Ext. Serv., Ithaca, N. Y., Bul. 382, Dec. 1937.

"Farm Economics," Cornell Univ. Agr. Ext. Serv., Ithaca, N. Y., Nos. 107 and 108, May and June 1938.

"County Agricultural Planning North Dakota," Agr. Ext. Serv., Fargo, N. Dak., Cir. 159, Nov. 1937, Harry G. Anderson.

"Better Land Utilization for Ohio," Agr. Exp. Sta., Columbus, Ohio, Mimeo. Bul. 108, June 1938, J. H. Sitterley and J. I. Falconer.

"Current Farm Economics," Agr. Exp. Sta., Stillwater, Okla., Series 49, Vol. II, No. 3, June 1938.

"Department of Agriculture of Oregon Bulletin," Salem, Oreg., Nos. 77, 78, and 79, April, June, and July 1938.

"Cost and Efficiency in the Filbert Enterprise in Oregon," Agr. Exp. Sta., Corvallis, Oreg., Sta. Bul. 351, June 1937, A. S. Burrier and C. E. Shuster.

"Pennsylvania Crop and Livestock Report 1934-1935-1936," Dept. of Agr., Harrisburg, Penna., Vol. 20, No. 4, Gen. Bul. 543, June-July 1937.

"What's New in Agricultural Research—Agricultural Economics," Agr. Exp. Sta., College Station, Brazos County, Tex., Prog. Report 496, Jan. 12, 1938, L. P. Gabbard.

"Farm Business," Agr. Ext. Serv., Burlington, Vt., Vol. 5, No. 2, Apr. 1938, H. R. Varney.

"Laws Relating to the Manufacture and Sale of Feeds, Fertilizers, and Livestock Remedies," Dept. of Agr., Olympia, Wash., 1938.

"The Meaning, Possibilities and Limitations of Cooperative Marketing," Agr. Exp. Sta., Pullman, Wash., Pop. Bul. 154, April 1938, E. F. Dummeier.

"Man-land Adjustment, A Study of Family and Inter-family Aspects of Land Retirement in the Central Wisconsin Land Purchase Area," Agr. Exp. Sta., Madison, Wis., Res. Bul. 134, Feb. 1938, Geo. W. Hill, Walter Slocum, Ruth O. Hill.

"Orchard Farming in Pennsylvania, Virginia, and West Virginia, A Farm-management and Cost-of-production Study in the Cumberland-Shenandoah Region in Pennsylvania, Virginia, and West Virginia, 1929-31," U. S. D. A., Washington, D. C., Mar. 1938.

"Income Parity for Agriculture, Part 1, Farm Income, Section 2, Income from Tobacco, Calendar Years 1909-37," U. S. D. A., Washington, D. C., May 1938.

"Wholesale Markets for Fruits and Vegetables in 40 Cities," U. S. D. A., Washington, D. C., Cir. 463, Feb. 1938, William C. Crow.

"Taxes: Who Pays, What For?" U. S. D. A., AAA, Washington, D. C., DS-9, Sept. 1937.

"Rural Communities: What Do They Need Most?" U. S. D. A., AAA, Washington, D. C., DS-10, Nov. 1937.

"Co-ops, How Far Can They Go?" U. S. D. A., AAA, Washington, D. C., DS-12, 1937.

"Farm Finance: What Is a Sound System?" U. S. D. A., AAA, Washington, D. C., DS-13, 1937.

"Crop Insurance: Is It Practical?" U. S. D. A., AAA, Washington, D. C., DS-14, 1937.

"Reciprocal Trade Agreements: Hurting or Helping the Country?" U. S. D. A., AAA, Washington, D. C., DS-15, 1937.

"Farm Security: How Can Tenants Find It?" U. S. D. A., AAA, Washington, D. C., DS-16, 1937.

"Clemson College Land Utilization Project," U. S. D. A., Washington, D. C., 52226, Mar. 1938.

"The Magazine Mountain Land Use Project, A 90,000-acre Demonstration in Better Land Use for Forestry, Recreation, Wildlife, Grazing," U. S. D. A., Washington, D. C., 56789, 1938.

"The Natchez Trace Land Use Project, A 26,000-acre Demonstration in Better Use of Land for: Forest Development, Recreation for All, Pasture Improvement, Wildlife Conservation," U. S. D. A., Washington, D. C., 56790, 1938.

"The Boston Mountain Land Use Project," U. S. D. A., Washington, D. C., 56791, 1938.

"The Northeast Mississippi Land Use Project, for: Forestry, Recreation, Grazing, Wildlife, A 90,000-acre Demonstration in Better Land Use," U. S. D. A., Washington, D. C., 56792, 1938.

"The Northwest Arkansas Land Use Project for: Forestry, Recreation, Grazing, Wildlife, An 18,000-acre Demonstration in Better Land Use," U. S. D. A., Washington, D. C., 56793, 1938.

"Toward Farm Security," U. S. D. A., Washington, D. C., Misc. Pub. 308, 1938, A. G. Black, Chief.

"Marketing Agreement Regulating the Handling of Hops Grown in the States of Oregon, California, and Washington," U. S. D. A., AAA, Washington, D. C., A-16, Agreement No. 78, Aug. 11, 1938, H. A. Wallace, Sec.

Both City and Farm Folk Study Soil Conservation

Farmers are not the only ones interested in soil conservation. The butcher, the baker, the family doctor, and the banker, on the corner are all keeping an eye on this new trend in agriculture.

Approximately 740,000 persons—from all walks of life—have visited demonstration projects and C. C. C. camp areas in various parts of the country to inspect and study scientific erosion control measures being used by farmers cooperating with the Soil Conservation Service in its demonstration program.

Of this total, about 500,000 have been farmers who wanted specific information about soil-saving measures and practices, says the Department of Agriculture. Others have inspected the demonstration areas because of public interest in the erosion control program.

Collecting the Price

(*From page* 17)

but he would have been saved trouble and delay if the contract had been absolutely clear.

When a farmer is entirely in the right and has the papers to prove it, he is paid interest on this delay. A New York grower, for instance, sold a carload of tomatoes as U. S. No. 1 f.o.b. and got a shipping-point inspection certificate. The buyer rejected the shipment on arrival. The grower called for a destination inspection and it upheld the shipping-point certificate of grade. He filed complaint with the Department of Agriculture which held that the buyer had rejected without reasonable cause and that he should pay the shipper $253.11, this sum being the difference between the original contract price and the resale price that was realized on the tomatoes, plus interest. A check for this amount was mailed to the grower by the dealer.

The Department of Agriculture settles these cases under the Perishable Agricultural Commodities Act. The purpose of this act is to suppress certain unfair and fraudulent practices in the marketing of fresh fruits and vegetables in interstate commerce. It provides that those who enter into contracts shall not repudiate them without good cause and that agents must tell the truth about their transactions. It is made unlawful for a commission merchant to dump or destroy products received by him for sale unless they are without commercial value, to fail or refuse to account correctly and to do it promptly, or to make fraudulent charges. Moreover, it is made unlawful for any licensed dealer to make false or misleading statements regarding a market or regarding the condition of produce.

The settling of cases under this Act is comparatively simple when there is a definite contract and when the contract is based on U. S. grades. These grades permit an easy interpretation of con-

tracts and a ready decision as to whether the goods supplied agreed with the contract. A shipping-point inspection certificate also helps in a quick settling. But though the law was passed several years ago, a surprising number of farmers do not know how to use it or do not have the right papers when they do invoke it.

Sometimes a lawsuit must be brought in order to settle a case, but an encouraging number of cases are settled amicably out of court, with this help from the Department. For instance, a buyer who bought a car of peaches f.o.b. shipping point for $583.98 claimed, when the car arrived, that the pack was slack and that some of the peaches showed soft bruises. The broker who negotiated the sale confirmed the buyer's inspection. When the case was referred to the Department of Agriculture the buyer agreed to accept the car but at a discount of $63, and the shipper agreed to accept the $520.98. This case also illustrates the fact that the act protects dealers as well as shippers and makes for fair play all along the line.

In fact its mere existence, and the cases that have been settled under it, now prevent many disputes and rejections that would have occurred before.

That the law works for the benefit of all—farmers, dealers, and consumers—is well illustrated in one concrete case.

A dealer in a large eastern city was reported so often and had so many cases decided against him that the Department of Agriculture placed him "on probation." He knew he was in danger of losing his dealer's license. He began to watch his step. A leading broker now tells the Department that previously he would not deal with this man, but that now this dealer has developed such a reputation for careful business, under the watchful eye of the inspectors, that he goes to this dealer first of all when he has a shipment of offer.

Improved Relations

Thus farmer-shippers are benefiting in this case, for they no longer have trouble when they ship to this dealer. Even though they got final justice before, by appealing to the Department, it was bothersome and their confidence in distance sales was weakened. Then they find that other dealers in that city are now more careful about their rejections. Brokers and other middlemen are benefiting because they is now one more reliable outlet for the produce they have to sell, and the new attitude of the other dealers also helps them. Consumers are benefiting because of the reduction of time and extra cost in handling these food products without disputes. The dealer himself decidedly benefits, through a better reputation and through an actual increase in good business. The case offers a practical example of the maxim that society as a whole loses when good crops are subjected to unscrupulous practices and gains when good crops are handled fairly under good business practices.

How I Control Black-Spot

(*From page* 11)

ties, there are also numerous weaklings.

Having experimented with ammonium phosphate (a chemical fertilizer containing 20 per cent of nitrogen and 50 per cent of phosphate), I have added to it enough muriate of potash to maintain the proportion of the atomic weights of the three substances, that is, so as to give about 3.5 times as much potash (and 2.5 times as much phosphate) as nitrogen.

This fertilizer affords an excellent quality of both foliage and wood. Obviously the three substances do not interact, strictly speaking, and thus justify their combination according to atomic

weight. On the contrary, they react with lime; but the high potash content in comparison with the usual formula has a scientific justification. The assimilation of nitrogen and phosphate can take place to the maximum extent only in the presence of an excess of potash, the assimilation of the latter being likewise at the maximum. Thus the perfect balance of this fertilizer, with a proportion of 1 of nitrogen, 2.5 of phosphate, and 3.5 of potash (or a formula of 4-10-14) is justified.

Quantity of Fertilizer

Of particular importance is the *quantity of* fertilizer. An acre should receive 36 pounds of available nitrogen, 90 pounds of available phosphate, and 126 pounds of available potash as a maximum dose; half this amount is adequate in rose nurseries. Keep strictly within these limits.*

Inasmuch as it is while plants are young that the maximum of nourishment is needed, and since my plants are always young because of hard pruning every year, it is necessary to give them the three principal elements of fertilizer for a maximum assimilation, without going to the extreme of overfeeding.

After solving my problems of soil and fertilizers, I found that the usual fungicides became fully effective. There was no more black-spot and no more mildew.

I here outline the fungicidal preventives I employ.

Experience has taught me that the first spraying is the most important; the prevention of diseases is very much better than cure. I begin when the first bloom opens (at the end of May), thus avoiding discoloration of the flowers at the height of their glory. The spray consists of bordeaux mixture made as follows: 4 pounds of copper sulphate and 2 pounds of flowers of lime in 25 gallons of water. Always pour the copper sulphate solution into the lime solution, never the reverse. For subsequent sprayings I use 6 pounds of copper sulphate to 3 pounds of lime. Two pounds of lime may be sufficient, but use enough to prevent the spray from being acid, as shown by a test with litmus paper. To this mixture one may add a solution of pentasulphur of potash at a dilution of 5 parts in a thousand, or a solution of lime-sulphur at the rate of 1½ pounds to 25 gallons, which gives 6 pounds of copper sulphate, 3 pounds of lime, and 1½ pounds of lime-sulphur in 25 gallons of water, the last stirred into the bordeaux mixture.

The greatest inconvenience of the complete spray is that the foliage is left with a tenacious black stain. In addition to its own reaction and to the catalytic effect upon the bordeaux mixture, lime-sulphur is a good fixing agent. During the time that I was struggling against black-spot, I always observed a certain therapeutic power in this complete fungicide. One may reduce the discoloration by waiting a day or two after the bordeaux mixture is applied before spraying with the lime-sulphur solution. I do this in order to stain my labels as little as possible.

I follow the spraying with this complete fungicide at the beginning of the first blooming period by three similar applications, that is, one each month until the first of September. After the second application I spray with the lime-sulphur solution every 15 days. This solution reacts against black-spot perhaps as effectively as bordeaux mixture.

Formerly I used colloidal sulphur against all rose diseases with success, but I can find it no longer. That sold today, I believe, is *colloidal* in name only. It is a product rendered very fine mechanically rather than through a chemical process. The future lies there, I believe, for the quantity required to be effective is infinitesimal and does not injure the foliage.

* The application of available ingredients recommended by M. Mallerin is equivalent to 900 pounds of fertilizer with a formula of 4-10-14 per acre. At this rate a bed of 100 square feet should be given about 2 pounds. On January 3, 1938, M. Mallerin wrote the translator that he applies potash in the fall and ammonium phosphate in March. The A. Meilland Nursery, which uses M. Mallerin's formula, fertilizes in January, but the nitrogen is applied in an organic form. This nursery has also reported in late January that the use of the Mallerin methods has given it almost perfect control of black-spot.—Editors.

A spraying of the utmost importance is that given in the winter. The material that I prefer above all others that I have tried is L'Elgétol, a product of the Truffaut firm at Versailles. It is an organic dye (colorant) that reacts powerfully as an insecticide and fungicide. In America there must be similar products. If they are lacking, one may fall back on the chemicals used on fruit trees. Sprays applied in the summer, such as L'Hélione of the Truffaut firm, will arrest black-spot; that is, if the infected portions of leaves are reached, an application of the complete fungicide the next day will immunize the foliage.

During wet periods it is obviously necessary to wait for fair weather to spray. The fungicide applied while the foliage is dry will remain effective during a long rainy period.

Strike a Balance of Soil Fertility

(*From page* 20)

land, much of which is subject to considerable leaching and some erosion. A $10,000,000 loss would probably be conservative for leaching and erosion. There is of course no adequate means for checking such estimates.

On the basis of the above estimate, more than $22,000,000 worth of fertility is lost from Oregon farms annually. On the basis of replacement needs, therefore, Oregon could use something over half a million tons of fertilizer annually instead of 12,000 tons. A few States use half a million tons or more yearly. Oregon probably never will use such a quantity, but the amount no doubt will increase considerably. Fortunately for the farmer, nature provides a certain amount of nitrogen replacement through micro-organisms, both symbiotic and non-symbiotic, which are active in the soil. This method of replacement may be utilized to minimize the nitrogen problem.

Improved farm methods might reduce losses materially, and thus reduce the need for purchased fertilizers. At present we are convinced that far too few farmers use any fertilizers, and most users apply inadequate amounts. Most of the fertilizer that is purchased goes for vegetable crops, small fruits, and orchards. This is because returns for such crops are higher, and appreciation of the importance of fertility is greater.

In one section beans grown for the cannery bring $500 an acre or more, but the acreage is limited. The use of 1,000 pounds or more of complete fertilizer on beans is justifiable and sometimes practiced. In a few cases a ton or more of complete fertilizer to the acre has been used on vegetable and fruit crops. Grain and forage crops are seldom fertilized and then only at moderate rates.

Interest in the use of commercial fertilizer is probably greater now than ever before. We wish to encourage this interest. We believe that it is a sound practice to rotate crops with frequent use of legumes on the general farm, and that the legume may supply most of the nitrogen necessary for general cropping. Humus renewal needs much emphasis in every type of farming and should precede or accompany the use of fertilizer. On acid, western Oregon soils liming is likewise necessary to grow legumes and make commercial fertilizers most effective.

Where erosion does not occur, 1 year of legume sod may about balance 1 year of clean cultivation for humus maintenance. Sod crops should occupy the land about 50 per cent of the time to provide humus renewal to offset losses

caused by cultivated crops grown the other half of the time. Stable manure is excellent humus material, but considering the quantity available on the average farm, manure is of minor significance either for renewing humus or as a fertilizer.

The kind and the amount is only a small part of the fertilizer problem on most farms. How and when to fertilize for best results are equally important. Fertilizers cannot be used successfully without adequate soil moisture. In western Oregon there are few summer rains and only a limited amount of irrigation. The irrigator has every advantage for working out a satisfactory fertilizer program. Where there is no irrigation, fertilizers must be used either in the fall or very early in the spring before moist weather ceases. Fertilizer applied in dry soil that remains dry through the season is not used by the crop, and fertilizer applied to a moist soil that later dries may cause burning.

Abundance of humus in the soil reduces the danger of burning, partly because humus improves soil moisture, and partly because the fertilizer is held by the humus and by the micro-organisms active in decomposing humus in a form that does not cause burning, but does feed the plant through the growing season. Nutrition of crops whether fertilized or unfertilized is better in the presence of abundance of active humus. Rotting organic matter stimulates the development of feeder roots on the crops and provides the conditions necessary for a crop well-fed.

For these and other reasons, fertilizing the cover crop grown for green manuring in orchards or truck gardens is a sound practice. Live roots penetrating and permeating the soil have a helpful effect even before rotting occurs. Crops such as clover and alfalfa that develop deep root systems improve the soil most. Shallow-rooted crops improve the surface soil, but are not as good as the deep subsoilers. The legumes make heavy demands upon the minerals, lime, phosphate, and potash. Legumes on good soils take care of their own nitrogen needs. In fact, the use of nitrogen fertilizer often only stimulates the grasses until the legumes are crowded out.

Successful fertilization is both a science and an art. The producer of highly specialized crops has the best opportunity to learn fertilization. Crops may be fed and watched for responses just as is true of animals, only the response is not always as soon or as easily detected. The trained eye of the plant feeder, as of the animal feeder, reads the signs and cuts down this or increases that according to needs. Perhaps the signs on the plant call for nitrogen, then a nitrogen fertilizer should be given. The response may show in a week or two.

The practice of side-dressing in growing garden crops is recently increasing. A liberal fertilization may be made at planting time, followed by three or four side-dressings through the fruiting season. A soluble nitrogen fertilizer is most commonly used for side-dressing, though a complete mixture can be used successfully.

Fertilizing for Best Results

There is much yet to learn in regard to the time and method of fertilizing. Too liberal use of fertilizer before planting may delay germination and retard the early growth period. Proper fertilizer placement does much to overcome this difficulty. Saving a portion of the fertilizer for a later date when the plant has become established may prove helpful. Plants absorb an enormous amount of nutrient when in the prime of their growth period. Probably the greatest need for nutrient is during the period of fruiting. Part of the nutrient for setting and maturing fruit must be previously stored ready for use, and part is absorbed or elaborated and used during the fruiting season.

The intensified production program of the market gardener demands, not replacement of nutrients removed by the crop, but a much more liberal fertilization of some elements. He may use two to four times as much nutrient

as his crops remove. Such liberal fertilization is necessary and justified, because a little improvement in yield or sometimes only an improved quality is necessary to pay for the extra fertilizer. One of the best orchardists in Oregon uses $40 to $50 worth of manure and fertilizer an acre. He has obtained acre-yields of 1,400 boxes of pears, and incidentally realized a long-nurtured dream of the finest orchard in his section.

Liberal and complete fertilization, rather than plant-food replacement, naturally goes with intensified and specialized farming. No longer is the old formula, N-P-K, considered a complete fertilizer. In different sections of the country the necessity of using calcium, magnesium, sulfur, copper, manganese, zinc, and boron carriers has become apparent. Probably other elements may be found deficient. Long cropping and removal, together with erosion and leaching, constantly bring out new deficiencies.

In the future, therefore, the fertility balance sheet may carry more items, for some of which partial replacement is necessary, while for others much more than replacement may be needed. Some elements for a long time to come may receive little consideration. The feeder of plants like the feeder of animals must be always alert for signs of inadequate nutrition. Perhaps it is a quantitatively insignificant vitamin-like substance that is deficient. If so, a few micro-grams may be as important to health and vigor in the plant, as several pounds of the more familiar and abundant nutrients. Plants grown in soil kept productive by adequate fertilization and humus renewal are usually both better for the consumer and more profitable to the producer.

Permanent Clovers for Permanent Pastures

(*From page 9*)

latter does not respond to additional nitrogen.

The high rate of potash and phosphorus was very much better than the low and shows the desirability of applying a heavy initial application on potentially good clover land. Merely plowing and reseeding without adding sufficient fertilizers are usually a waste of time and seed, and on heavy soils a

TABLE 2—YIELD OF HERBAGE PRODUCED ON DIFFERENT CLOVER PLOTS WITH VARIOUS FERTILIZERS. (WOODBRIDGE CLAY LOAM)[1]

Fertilizers Used[1]	Pounds of Dry Matter per Acre							
	1934	1935	1936	Total	1934	1935	1936	Total
	(Native Wild White Clover)				(Ladino Clover)			
L Only	418	1,351	1,287	3,056	59	1,490	1,777	3,326
L+P_1+K_1	581	1,894	1,691	4,166	696	2,871	2,103	5,670
L+P_2+K_2	808	2,669	2,370	5,847	1,447	3,530	2,346	7,323
L+P_2+K_2+N	1,565	3,324	2,961	7,850	1,645	3,654	2,798	8,097
L+P_2+M	1,272	2,932	3,072	7,276	1,603	2,368	2,075	6,046
	(Kent English Wild White)				(Common White Dutch Clover)			
L Only	.....	1,587	1,441	3,028	35	1,522	1,232	2,789
L+P_1+K_1	39	2,543	1,766	4,348	649	2,253	1,638	4,540
L+P_2+K_2	813	3,696	2,623	7,132	1,445	3,475	2,340	7,260
L+P_2+K_2+N	855	4,175	3,061	8,091	1,543	3,713	3,230	8,486
L+P_2+M	475	2,403	2,298	5,176	1,070	2,325	1,982	5,377

[1] For explanation of fertilizers used see bottom of table 1

poor turf is obtained which allows the soils to bake.

Plowing is usually unnecessary in establishing a good pasture high in natural wild white clover, because under proper conditions it usually "comes in." In fact, plowing is usually detrimental, since it turns under the surface layer of organic matter and places it in a position where most of the feeding roots cannot reach it. In addition to the ordinary physical and chemical properties attributed to organic matter, it seems to supply food and proper conditions for the clover organisms. A small application of farm manure on clover pastures seems to be much more beneficial than an equivalent amount of mineral fertilizer. Some of the best clover pastures in England are never plowed, and they realize that it takes a long time for good pastures to develop, during which time a surface layer of dark humus is produced.

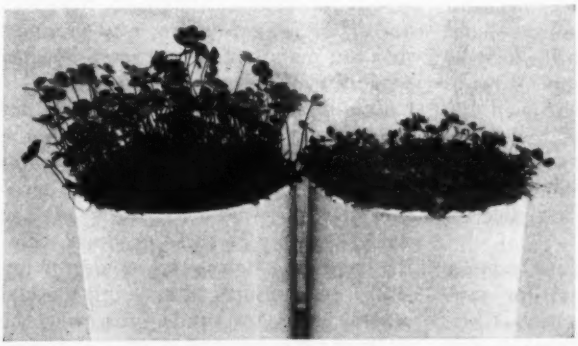
Keep in Permanent Pasture

Since it is quite difficult, if not impossible, to purchase natural wild white clover seed, the land should not be plowed, but kept in permanent pasture so that these plants might develop. It is quite difficult to understand where the seed comes from, but it is known that white clover produces a large number of "hard seed" which do not absorb water and thus remain dormant for a long time. That a large number of seed are transferred about the grazing stock is also known, which is evident by the large number of clover seedlings which germinate in the dung deposited by cattle on pastures.

Pasture clovers require plenty of available phosphorus and potash for adequate growth, and since most pastures are low in these minerals they must be applied in the fertilizer. While natural wild white clover will tolerate rather acid soils, some lime is very desirable, as it helps to keep the minerals more available.

Most dairymen make the mistake of not applying sufficient phosphorus and perhaps potash as an initial application, particularly on run-down lands that are potentially good clover soils. It should be remembered that myriads of soil organisms are stimulated by the use of fertilizers, and these organisms must first have their wants supplied before any are available for crop plants. Repeated observations, as well as some experimental data, indicate that 1,000 pounds of 16% superphosphate (800 lb. 20%) together with 150 pounds of muriate of potash may well be used as an initial application on potentially good permanent pastures to establish and maintain wild white clover. Less potash may be used on heavy soils, but on sandy loams more potash and less phosphorus may be desirable.

Close grazing is very important in establishing and maintaining wild white clover. This is especially true in early spring, since most grasses make their maximum growth sooner than clovers and thereby shade and crowd out the latter. A clover-dominant or grass-dominant pasture may be secured by changing grazing methods, the former by close grazing which checks the growth of grass, the latter by allowing the grass to grow up and check the clover.



The common white Dutch clover (left) is more erect but less compact than the natural wild white clover (right).

On clover-dominant pastures, stock should be turned out as soon as the ground is dry enough to carry them. In spite of this early grazing, some grasses will reach the heading-out stage and should be cut with a mowing machine. At times more than one mowing is necessary, but this is a good practice, as waste is reduced and more pasturage made available. In a partially withered condition, freshly cut herbage is readily eaten by stock, and a splendid new growth replaces it. Animals usually avoid vegetation around their droppings, but since the mower cuts and carries the herbage a short distance away, it is readily consumed.

Considerable care should be exercised in the use of nitrogen on permanent pastures where wild white clover is to be maintained. A small amount with minerals usually aids this clover in getting established, especially on run-down soils, but after a good stand is obtained, additional nitrogen should not be used because it tends to crowd out the clover. Improper use of nitrogen with its accompanying increase in growth of grasses often accounts for failure to maintain a good clover sod. However, an initial application of complete fertilizer containing nitrogen is often advantageous on run-down permanent pastures, because it increases yields and gives a quick visible response while the natural clover is getting established.

Rather large amounts of nitrogen may be advantageously used on semi-permanent or meadow pastures, when this type of pasture is used in conjunction with a permanent one. Tall-growing hay-type grasses respond readily to this treatment and will give extra grass for early-cut hay or grass silage. This allows an aftermath to follow which is used when most needed in late summer.

Most dairy farmers, especially in New England where wild white clover can be grown, should consider the possibility of having these two types of pastures—permanent pastures where wild white clover supplies the needed nitrogen and semi-permanent or rotational pastures where nitrogenous fertilizers are used to supply the taller-growing grasses. Both fertilization and management of these two types are very different and must be understood for successful results.

Dixie—Land of Cotton and Forests

(*From page* 19)

this raw material upward. A large number of mills have located mostly along the Atlantic seaboard, the Gulf of Mexico, and northern Louisiana, and by the end of 1938 there will likely be 37 or more of these mills operating in this region. Thirty of them will use pine as their main source of raw material. Suffice it to say that this region now has over 40 per cent of the potential raw material in the nation available for wood pulp manufacture.

A number of factors combine to make the gulf coast region ideal for sawmilling and paper mill operation. Chief of these are large areas growing raw materials, long growing season and abundant rainfall to give high per-acre production, mild winters for continuous woods operation, abundant materials and labor for converting raw products into the manufactured articles, and accessibility of the principal markets.

One branch of forest activity not touched by any other section of the United States is that of naval stores (turpentine and rosin). In this territory is produced two-thirds of the world's supply of these products, coming from the longleaf and rapid-growing slash pines, which, after being worked several years for crude gum, may be utilized for pulpwood or other purposes.

The southern farmers, who own 30

per cent of all timber land in these 11 States, are large recipients of much of the income derived from forestry and are in the best position of all woodland owners to practice forestry. Their home demands for woods products are large and mostly supplied from their own holdings. The average family of five requires 12 cords of wood for fuel annually, and to this may be added lumber and other products for buildings and repairs and posts for fences. The 59 million acres of farmer-owned timberland will, with reasonable care, mean a steady cash income of more than a hundred million dollars in raw products while demanding very little outlay of capital.

Cooked Potatoes Blacken Because . . .

(*From page* 14)

the element did seriously depress plant productivity.

The use of large proportions of potassium salts has tended to overcome, in part, the deficiency of boron. Of course, this may be due to traces of boron carried by such salts. It is possible, also, that this beneficial effect sometimes accompanies the liberal use of potash in commercial fertilizers.

No vegetative disturbances were noticed when either copper or manganese was omitted from the sand cultures. Potato plants grown on low potassium mixtures to which copper and boron had been added did not show the typical boron response and resembled more closely a healthy plant. Those grown on low potassium soil to which manganese and boron had been added showed the same reaction. Because in both of these cases the potatoes were of ordinary size, here again the effect of boron in promoting plant productivity was noticed.

Only the large potatoes grown in the soil lacking boron, copper, or manganese were examined after cooking. No distinct effect on the blackening was noticed. Before any definite statements are made about the effect of rare minerals on blackening, the problem must be subjected to further research.

Rural New Yorkers grown on a plat which had not been fertilized for 6 years turned very black upon cooking. This supports the foundation theory that a lack of available minerals in the soil has a direct effect on the darkening.

It has been found, also, that the moisture in the soil influences the amount of potato blackening. The condition was much more pronounced in years of drought or in dry, unirrigated areas. In limited observations where irrigation was practiced, not only did the potato crop improve, but if a reasonable amount of fertilizer was used, there was little darkening of the tubers on cooking. In 1936 plants grown on irrigated plots in Madison produced potatoes that remained entirely white upon cooking. Apparently, the higher soil moisture made the potash and other elements in the soil more available.

Heat may be more critical in producing the darkening than some other factors of climate, believes Dr. Tottingham. This is, however, subject to experiments in which the heat, as well as the amount of moisture, is controlled.

Research has also proven that neither the immaturity of the potato vines at the time of harvesting nor storage in warm, poorly ventilated places influences the blackening of potatoes to any great extent.

Since personal judgment enters into the direct observation of the amount of darkening of potatoes, a photometric instrument is being used in England to measure the color of cooked potatoes. A series of colored cards is used as a standard for judging the color of the

mashed tissue, the colors being reflected by mirrors and then adjusted so they match. The final judgment of discoloration is thus made independent of the natural pigments of the tuber. Research workers at the University of Wisconsin hope to develop a similar instrument to be used in their studies.

The experiments on potato blackening at the University of Wisconsin have led to the following conclusions:

1. The blackening is caused by the reaction of certain free amino acids in the potato and oxygen.

2. The condition is physiological and not pathological.

3. Providing the rainfall or soil moisture is sufficient, an increase in the amount of potassium in the soil is associated with a decrease in the amount of potato blackening.

4. The supply of rare soil elements, including zinc, copper, manganese, and boron, may also affect the amount of potato blackening.

5. The sustained growth of a potato plant is dependent, in part, on boron. Soils with none or very little of this mineral produce a plant that tends to vegetative breakdown and poor tuber production. There are grounds for suggesting that the liberal use of potash in fertilizers may, at least, delay the unfavorable responses of the plant to a lack of boron.

6. The moisture in the soil seems to influence blackening. Potatoes grown on dry areas or during dry years, have generally shown more darkening than the limited number of samples observed from moist or irrigated regions.

7. Heat may be more critical than some other factors of climate in its effect on potato blackening.

8. Neither the immaturity of the potato vines at the time of harvesting nor storage in warm, poorly ventilated places greatly influences the blackening process.

Quality Potatoes from Muck Soils

(*From page* 22)

FERTILIZER PLOTS, 1937, NORTHERN INDIANA MUCK CROPS EXPERIMENTAL FARM, WALKERTON, INDIANA

Fertilizer Analysis*	Bushel per Acre Cobbler Potatoes	Increase in Bushels per Acre Over No Treatment
0–0–0	142	0
0–8–0	190	48
0–0–24	263	121
0–8–8	264	122
0–8–16	280	138
0–8–24	293	151
0–8–32	298	156
0–8–40	306	164
0–24–24	302	160

* Rate of broadcast fertilizer applied per acre, 1,000 pounds.

the seed, gave results equal to those obtained from 500 and 1,000 pounds broadcast. With 500 pounds per acre applied in bands beside and below the seed, an increase of 15 bushels per acre over the broadcast treatment was obtained. With the 1,000-pound application in bands, the yield was further increased to 27 bushels over the broadcast treatment, but this means that the farmer must sell the extra 12 bushels of potatoes at about $1 per bushel to pay for the extra 500 pounds of this fertilizer.

Except under a few unusual conditions, potatoes do not respond to applications of minor elements on Indiana mucks. On a muck of pH 5.2, no response has been obtained from soil applications of copper sulphate, manganese sulphate, magnesium sulphate, zinc sulphate, borax, or sodium chloride. In the case of some other mucks, usually more acid than pH 6, on which onions have responded to applications of copper sulphate, there is a possibility that

The 1935 state champion, Perry Ort of Huntington, Indiana, grew the Cobbler variety.

potatoes would benefit also. If, however, the foliage is well sprayed or dusted with Bordeaux mixture, any deficiency of copper in the soil is likely to be taken care of.

If a soil approaches the neutral to alkaline condition, yellow spots may show up in fields of potatoes. The condition resulting from the yellowing of the leaves between the veins may be controlled by applying 50-100 pounds of manganese sulphate per acre in bands along the row. This condition is common on fields which have received too heavy applications of lime.

Use New Varieties

One of the factors contributing heavily to an increased acreage of muck potatoes is the introduction of new varieties and the use of a so-called early variety for a main crop.

The Cobbler has been used more extensively in recent years, because it is white and produces good yields. It has the disadvantage of having deep eyes, which makes it difficult to clean.

Two newer varieties which are producing good yields are the Katahdin and Chippewa. These white-skinned varieties are of good quality when grown on well-fertilized muck and are easy to clean and pack. The Katahdin, and, to a lesser extent, the Chippewa set the tubers close to the surface, so that sunburn is one factor to be overcome. Hilling of these varieties is recommended on the last cultivation and, if necessary, an extra hilling operation may be given them just before the vines are mature, unless the potatoes are to be dug immediately.

Both the Russet Rural and White Rural are still grown throughout the State. These varieties yield well but are more difficult to market. Two characteristics which cut down the percentage of No. 1 potatoes from these varieties are growth cracks and hollow heart. Hollow heart can be controlled to a limited extent by close planting. The fact that these varieties make a good total yield in spite of adverse conditions will probably keep them on the market for many years.

A new variety which showed promise on muck in 1937 is the Houma. It is similar in shape and type to Katahdin.

Other varieties which are not consistently good yielders on muck are: Green Mountain, Warba, Triumph, White Gold, and Golden.

The date of planting is very important in influencing the yield. This

is especially true with Cobblers. The earliest plantings have given the highest yields over the past few years. These plantings in Indiana were possible from the fifth to the fifteenth of May. There is more hazard from late spring frosts with this planting than with plantings made later. The yield of plantings made one month later was materially less. Plantings made after June 15 to July 1 outyielded those plantings which begin to mature during the period when temperatures approach 90°-100° F. The later plantings are usually caught by the first fall frost, which in northern Indiana is likely to occur about September 10-15. A general rule is to plant as early as is possible, taking into consideration the frost-free date in each local section.

Close Spacing Increases Yield

Close spacing of seed pieces on muck tends to increase vield, improve the quality of the packed product, and in case of frost may protect plants from complete freezing.

The rows should be planted as close together as the equipment used in planting, cultivating, and digging will permit. Most equipment can be adjusted to work 36-inch rows, while some growers plant down to 28 inches and 32 inches. When planting in 28-inch rows, the seed pieces should be spaced 12 inches apart in the row. This space can be decreased where the rows are further apart. For 36-inch rows the spacing between seed pieces can be 8-10 inches. The quantity of seed used per acre varies with the variety. Rurals and other varieties which have many eyes, thus cutting to advantage, require from 20-35 bushels per acre. Some of the smoother varieties, having fewer eyes, require 30-40 bushels of cut seed per acre.

Close planting tends to keep down the size of the tubers, eliminating much of the hollow heart which shows up in the wider spacing. This results in a higher percentage of No. 1 potatoes for packing.

The sooner the vines cover the soil, the less danger of loss from light frosts. If the plant stands individually, even a light freeze will kill it; while if the vines blanket the soil, less heat will be lost from the soil, damage will occur only on the upper leaves, and the vines will rapidly recover.

The planting depth best suited to most mucks is 3½-4 inches. If Rhizoctonia or black scurf is present on old fields, the covering disks on the planter may be set to throw only 1½-2 inches of soil over the seed pieces, thus allowing the sprout to come through before the rest of the soil is worked in. This may help to control the disease.

Frequency and depth of cultivation on muck depends on (1) weed control and (2) weather. Under ordinary conditions shallow cultivation is most practical. Control of weeds is of primary importance. With some varieties, hilling is recommended on the last cultivation. In case of extremely wet weather, deeper cultivation is required to insure proper growth. The aeration of the soil encourages the production of nitrogen, which is essential to high yields.

The expected yield of potatoes on muck soil is naturally dependent on weather conditions in addition to all other factors within control of the grower. Assuming no severe drought or prolonged period of rain, the grower may expect average yields of 200 bushels per acre, and with ideal weather conditions, yields of 400 bushels are not uncommon if the following rules are observed:

1. Select the proper soil.
2. Use at least 500 pounds of fertilizer, 0-8-24 or similar analysis high in potash, applied in bands beside and below the seed pieces.
3. Use good seed, certified or equivalent.
4. Plant close and at proper depth.
5. Use good cultural practices.
6. Treat seed and spray or dust according to recommendation of your county agent or State experiment station.

Which, and if so, Why?

(*From page* 5)

Similarly I have known whole communities of a rather small bore educational status to flock into the mass movements where leadership is dynamic and dramatic rather than logical or conservative. Likewise I have seen them drift away and become surly and disillusioned in just as quick formation.

Thus we have the trained, thinking individualist on the one hand, and the enthusiastic, volatile, rough and ready joiner on the other; and they all make up the great body of folks we call farmers in the United States census.

AND now, besides this effect of individual character on the result, we also have the matter of psychology or popular feeling to put in its oar. We can't consider either education or organization without talking psychology. It's as old as the hills but somewhat late in being recognized for what it's worth.

We have just passed through the threshing-machine beaters of an economic upheaval, and maybe we haven't got to the straw stack yet. It left an indelible impress on hosts of farm folks in every section of America. Now witness that along with this distress we had more cause for united action, and today we boast 3,200,000 farmers enrolled in all forms and fashions of cooperation, allowing for duplication. This study by the Farm Credit Administration shows clearly that stiff economic pressure drives men into herds to huddle like sheep for warmth and protection. Yes, and I reckon a few of those old "lone eagles" are glad to seek some degree of shelter along with the rest.

We might claim that a sort of education in the school of hard knocks forced these fellows to cooperate; but we have grave doubts that any formal education had much to do with the rise of the cooperatives in the past decade. Likewise it is too early to point out the achievements of these same hustling new cooperatives with their new financial plans and say they have beaten education to the high dollar.

If we take the other kind of cooperation, that of plant and animal breeding, as a rule we find these groups limping and lamenting a dearth of membership during the depression periods. These units have largely been fostered by professors or graduates of institutions. I have sometimes called them cow-operators to distinguish them from the regular co-operators. But I do not claim that there is the least relationship between their origin in academies and their relative lack of popularity in hard times.

"A-ha," I hear you exclaim at this moment, "there is a huge hole in your thesis big enough to let Doug Corrigan drive his plane through. You forget that many volumes have been written on cooperation in marketing by the college lads."

QUITE true, but the organizers are the ones who get the signatures and keep the boilers hot; and few there are among the rank and file who really know what it's all about. The bulletins are too long, you know, and time is fleeting when economic devils have the whip hand. And we all know it's just in recent years that the colleges left the breed clubs to jump aboard the marketing band-wagon.

All I am aiming at is this: that we have individualistic persons and gregarious people to deal with in agriculture; and we have examples of how economic organizations gained fast while purely educative organizations languished during the terms of stress. It doesn't blame the result on education or lack of education, but it points the way to a new manner of getting our education and using it where it counts most.

We want more trained, highly in-

tense minds to join farm organizations because it will do them both good. We must seek a way to stabilize and increase the growth of bona fide serviceable farm organizations, both cooperatives and breed clubs. To get this ideal we should insist on more trained leadership. Such leadership will command more respect from those who formerly stayed away from the rallies and the super co-ops. Such leadership will also set up policies and programs to instil confidence among the everyday joiners, who do not have the inclination to visit ag libraries every week to catch up in their thinking.

Some of my friends in the hinterlands get skeptical sometimes and holler that despite all the colleges and the laboratories and the many mass movements and overall alliances we have had, our farmers are sinking deeper into debt and acquire less than ever of the total national mazuma.

They even claim that new inventions have been the cause of farmers reaching out too far beyond their means for comforts and conveniences, and that proficiency has not made plenty safe or desirable.

I listen to these clamorous voices with rectitude. They are entitled to their say-so, and maybe they give us a jolt in the breeches when we need it most.

YET I remain adamant in my own conceit. I reply that all such criticism is folly at bottom. Human nature will always be restless for new facts and new horizons. They will want bigger and better ways of plowing and planting and harvesting, and remain just as eager to unite en masse to secure a strangle hold on the fruits of their toil. Any doctrine that steps us backward is doomed, except that which anchors us to the scriptures and the essence of ethical conduct. That alone will live to serve us, while all the residue of the past age of farm mechanics and farm economics is dead and buried. As far as I am concerned, you can't dig a hole deep enough to hold most of it.

No, we haven't done with education yet, because it means more to the future of organization than any of our elders dreamed. So too, we cling to organization, but insist it must come out and have its face washed and get a little brain exercise. Unless these two arms of the ancient art of agriculture are muscular and adept, we are due for a tremendous licking.

ASSETS we have a-plenty to start this dual formation. Illiterate farmers are rapidly disappearing. The splendid work of the junior organizations in 4-H clubs and the Future Farmer chapters blends organization with forceful kinds of applied education. In a few high spots we have new departures in agricultural college short courses which transplant the Danish folk school to our land and weave its ideals into the American pattern.

But my final hunch in this treatise is that what we shall stumble upon in the near future is a totally new sort of school system. If I do not mistake the signs of the times in class rivalry, we are going to be forced sooner or later into a scheme of schooling for leadership which differs from any we have enjoyed hitherto.

I vision a school for these leaders which will bring together the best thinkers and most energetic minds in farming, in industry, in labor, in commerce, and in capital. They will study the common interlocking problems facing us, and which today are a barrier to genuine national progress.

They will not wear any party label or any man's brass collar. Maybe they will arrange to exchange leaderships each season or two, just as the churches used to do in revival sessions. We have simply fixed up too many closed closets for each group to pray in, and the good Lord has been deaf to this clatter for a good reason. I think if we do less praying separately and more fighting unitedly we are going to quit worrying whether education or organization has won the race.

EXPLANATION

"Sambo, Ah'd lak yo'-all to expatiate on de way de radio works. Ah can't understand dat yet."

"Dat's easy, Rastus. Take de telegraphy. Ef dey was a dog big enough so his head could be in Washington and his tail in Chicago, den ef yo' was to tromp on his tail in Chicago he'd bark in Washington."

"Ah understands dat, but what's dat got to do wiff radio?"

"It's jes' presac'ly de same, Rastus, wid de exception dat de dog am imaginary."

She: "I want a man who doesn't drink, smoke, swear or philander."

He: "What for?"

A woman found a fly in her soup and said crossly, "Waiter, what is that?"

The waiter said, "That, Madame, is a Vitamin Bee."

Advice to Co-eds: "If you are looking for a real thrill, try kissing a man with hiccoughs."

And then there is the girl who climbs the ladder of success wrong by wrong.

Jim: "Mother, that little girl keeps staring at me all the time."

Mother: "I didn't notice. Which little girl was it?"

Jim: "That little girl in the seat behind us."

Flink: "Quite a stir was caused by an old maid in the seed store yesterday."

Wink: "How come?"

Flink: "She walked in and asked how to sow wild oats."

Young Mother: "What makes you think our boy is going to be a politician?"

Young Father: "He says more things that sound well and mean nothing than any other human being I ever saw."

She: "I weighed myself this morning and I weighed just 110—stripped."

He: "Yes, but you can't trust those drugstore scales."

QUIET PLEASE

A deaf but pious English lady, visiting a small country town in Scotland, went to church, armed with an ear trumpet. The elders had never seen one and eyed it with suspicion and uneasiness.

After a short consultation, one of them went up to the old lady just before the opening of the service and wagging his finger at her warningly, whispered, "One toot and ye're oot."

A shoulder strap is what keeps an attraction from becoming a sensation.

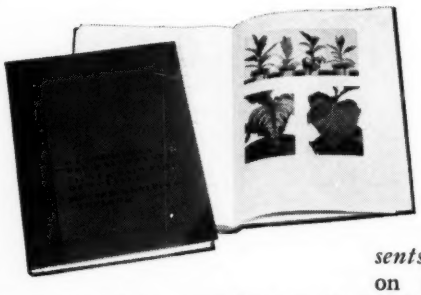
1st Rah Rah: "She's pretty as a picture."

2nd Rah Rah: "Yeah, nice frame, too."

Potash Deficiency Symptoms

By ECKSTEIN - BRUNO - TURRENTINE

(248 pages, in German, French, and English—profusely illustrated with 55 plates in 4 colors and 41 striking figures in black and white.)



THIS publication *presents* comprehensive information on characteristic potash deficiency symptoms appearing on 45 of the most important cultivated crops. Comments accompanying each color plate make this a very practical hand-book for identifying potash starvation.

. . . "It is a valuable reference book for growers, students of vocational agriculture, and for extension workers."—H. H. Zimmerley in *Market Growers Journal.*

. . . "This book is an elaborate and attractive publication, and is destined to meet a keenly-felt want by instructors and research workers, as well as practical growers, in agriculture and horticulture all over the world."—*The Fruit Grower.*

. . . "This is a most commendable form of placing before the peoples of the world the facts regarding potash as a necessary plant food."—C. A. Shull in *Botanical Gazette.*

. . . "This publication is exceedingly valuable in that it brings together material from scores of research institutions, and presents accurate descriptions and illustrations. The collection of plates could not be assembled by any individual except at great expense, and the cooperating potash organizations have rendered valuable service to agriculturists in presenting this work at such a moderate charge."—C. S. T. A. *Review.*

. . . "The volume contains a valuable study of deficiency symptoms, strikingly illustrated."—H. P. Cooper in *Journal American Society of Agronomy.*

. . . "Any one interested in the mineral nutrition of plants will be glad to study this interesting treatise on potash deficiency in plants."—A. R. C. Haas, in *California Citrograph.*

A leaflet in the original size of the book, containing more detailed information, will be sent free upon request.

Bound in half leather . . . . . Price $2.25

B. WESTERMANN CO., INC. **20 West 48th St., New York, N. Y.**

Printed in U.S.A.